Table of Attachments
(2014 Fact Sheet WVWA WPCP VA0025020)
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Attachment A

Flow Frequency Memorandum

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY - WATER DIVISION
3019 Peters Creek Road Roanoke, Virginia 24019

SUBJECT: Flow Frequency Determination
WVWA WPCP - Reissuance

TO: Permit File

FROM: Becky L. France, Water Permit Writer BLF

DATE: July 30, 2013

The Western Virginia Water Authority WPCP discharges to the Roanoke River. Stream flow frequencies are required at this site for use in developing effluent limitations for the VPDES permit. This memorandum supercedes the October 20, 2008 memorandum concerning the subject VPDES permit.

The USGS has operated a continuous record gauge on the Roanoke River at Roanoke, Virginia (#02055000) since 1899. The flow was regulated by power plants upstream prior to 1949. The gauge is approximately 2.5 miles upstream of the discharge point. The flow frequencies for the gauge are based on the period from 1950 through 2011. Prior to 1950, flow was regulated by power plants upstream. The values at the discharge point were determined by drainage area proportions and do not address any withdrawals, discharges, or springs lying between the gauge and outfall 001.

The high flow months are January through May. Flow frequencies are listed on the attached table.

Flow Frequency Determination: WVWA WPCP

Reference Gauge (data from 1950 to 2011) Roanoke River at Roanoke, VA (#02055000)					
Drainage Area [mi^2] =	384.0				
	ft^3/s	MGD		ft^3/s	MGD
1Q10 =	33.8	21.8	High Flow 1Q10 =	67	43
7Q10 =	38.2	24.7	High Flow 7Q10 =	79	51
30Q5 =	57.1	36.9	HM =	147	95
30Q10=	48.5	31.3	High Flow 3010=	103	67

Flow frequencies for the reissued permit (2/21/14) Roanoke River at Discharge Point					
Drainage Area [mi^2] =	**401.4**				
	ft^3/s	**MGD**		**ft^3/s**	**MGD**
1Q10 =	**35**	**23**	**High Flow 1Q10 =**	**70**	**45**
7Q10 =	**40**	**26**	**High Flow 7Q10 =**	**83**	**53**
30Q5 =	**60**	**39**	**HM =**	**154**	**99**
30Q10=	**51**	**33**	**High Flow 30Q10=**	**108**	**70**

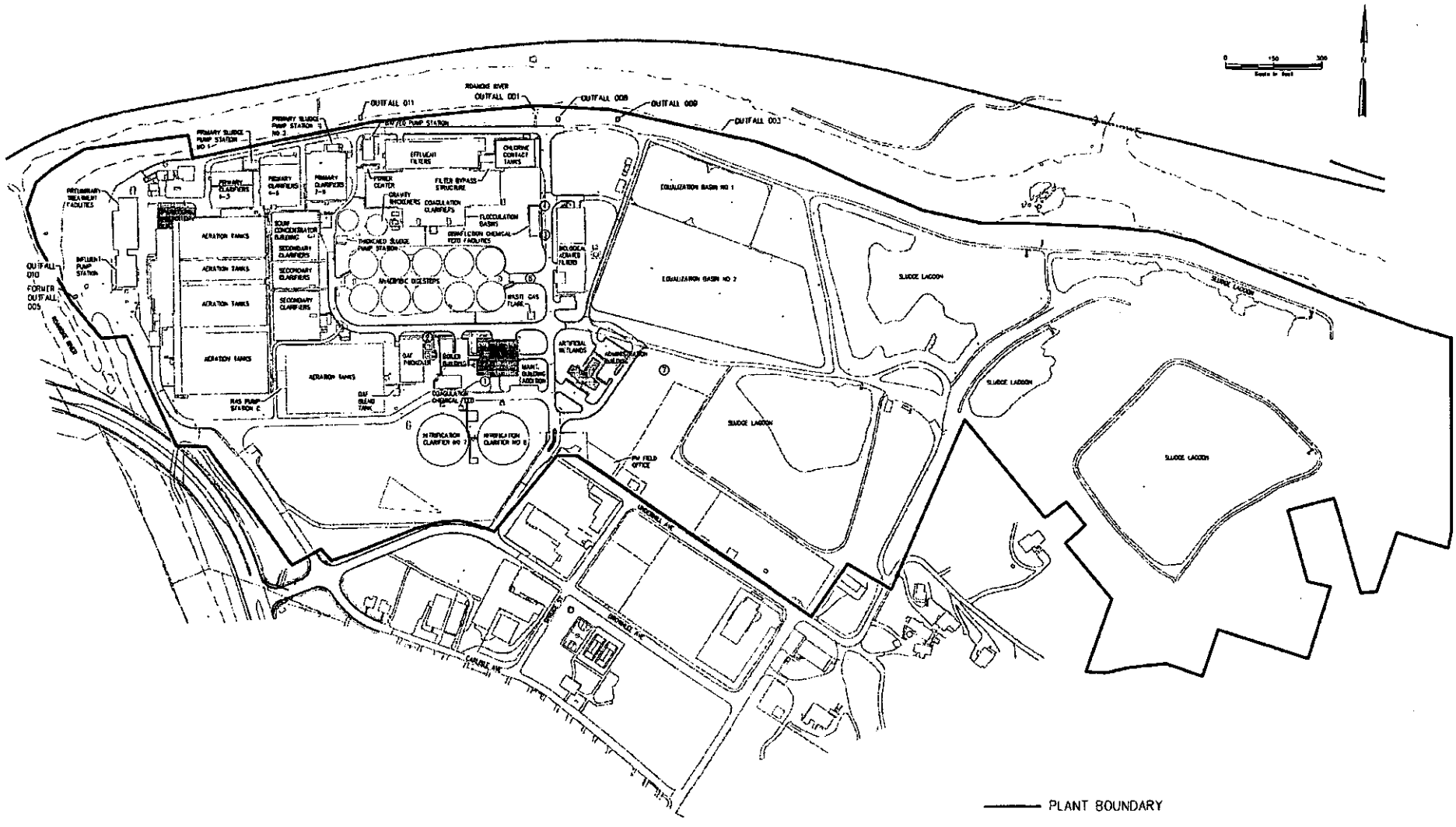
w

Roanoke River at Walnut Street in Roanoke, VA
Station No. 02055000
Lat 37 15'30", Long 79 56'19", NAD 83

Record	DaArea	Harmean	HF30Q10	HF7Q10	HF1Q10	Z30Q5	Z30Q10	Z7Q10	Z1Q10	Z1Q30	HFMTHS	Statperiod	Yrstrm	NOTES
R, 1899-	384.0	147	103	79	67	57.1	48.5	38.2	33.8	24	JAN-MAY	1950-2011	2011	regulation by power plants upstream prior to 1949

Attachment B

Wastewater Schematics and Outfall Location Maps



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WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT

FACILITY LAYOUT MAP

PROJECT NO. 25154

DATE: 8/2013

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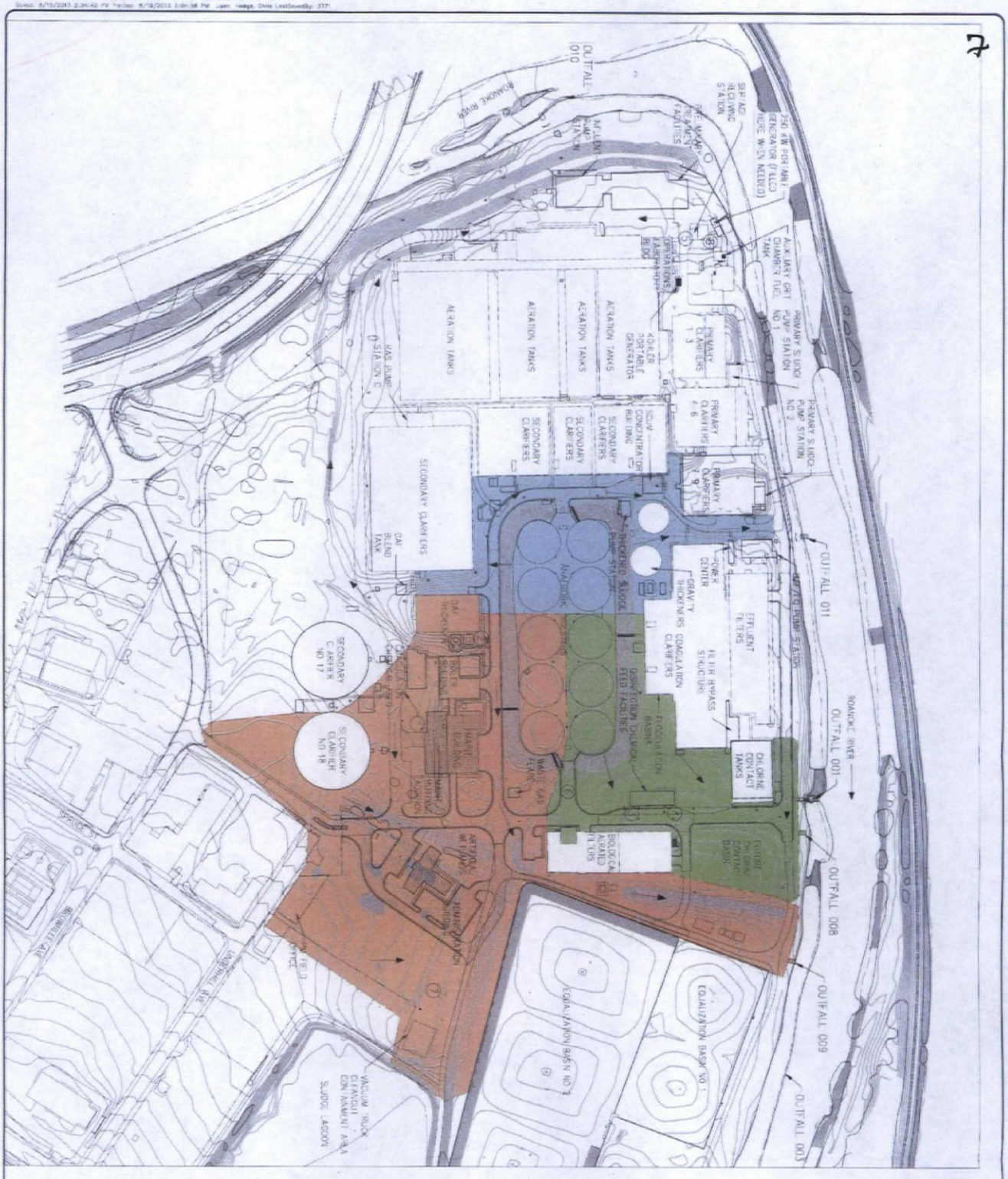

WATER POLLUTION CONTROL PLANT

SITE MAP
STORM WATER DRAINAGE BASINS

Issue Date: 8/2013 | Project No.: 22858 | Scale: AS SHOWN

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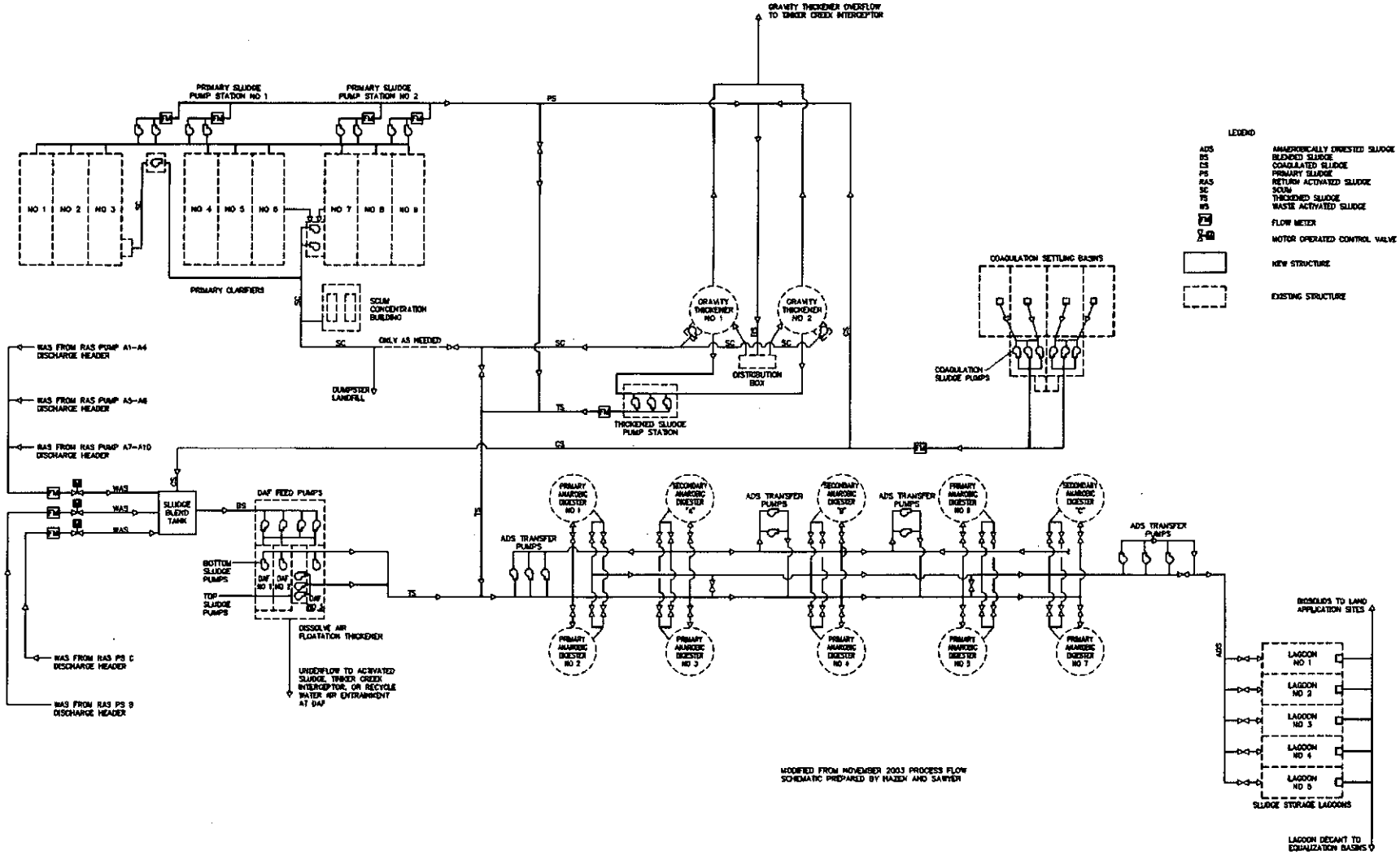
Designed: | Drawn: | Checked:

WESTERN VIRGINIA WATER AUTHORITY

No.	Submittal / Revision	Appr'd	By	Date
1	SWPPP INSPECTION	RLH		6/1/10
2	SWPPP INSPECTION	RLH		6/14/11
3	SWPPP INSPECTION	RLH		6/18/12
4	VPDES PERMIT APPLICATION	AOM		8/16/13



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WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT
PROCESS FLOW DIAGRAM
SOLIDS TRAIN

PROJECT NO. 25154

DATE: 8/2013

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Attachment C

Facility Information

- Site Inspection Report
- Industrial Wastewater Contributors
- Special Order by Consent

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Blue Ridge Regional Office

3019 Peters Creek Road Roanoke, VA 24019

SUBJECT: Site Inspection Report for WVWA WPCP
Reissuance of VPDES Permit No. VA0025020

TO: Permit File

FROM: Becky L. France, Water Permit Writer

DATE: September 26, 2013

On August 12, 2013, a site inspection was conducted at the WVWA WPCP which is located in the City of Roanoke. Mr. Scott Shirley, Wastewater Manager; Marty Sensabaugh, Wastewater Division Manager; and Janice Richardson, Pretreatment Coordinator; Lawrence Hoffman, CHA Director of Environmental Services; and Amanda Marsh, CHA Engineer were present at the inspection. According to the permit application, the Western Virginia Water Authority WPCP serves a population of approximately 248,100 in Roanoke City, Salem City, Botetourt County, Roanoke County, and Town of Vinton. The facility receives industrial wastewater from thirty two significant industrial contributors and operates an approved pretreatment program. The existing advanced treatment system consists of grit removal, primary clarification, biological activated sludge treatment, secondary clarification, chemical coagulation, filtration, disinfection, dechlorination, and post aeration. Sludge treatment consists of gravity thickening, dissolved air flotation thickening, anaerobic digestion, and lagoons. The plant is served by a dual power feed from American Electric Power and has a 2.3 mw backup generator. During the permit term the permittee has completed rehabilitation work to address inflow and infiltration of the Roanoke River and Tinker Creek Interceptors. The permittee is working a parallel relief sewer to the Tinker Creek Interceptor.

Wastewater Treatment Processes

Preliminary Treatment -- Flow enters the plant through a 66-inch Roanoke Interceptor and a 54-inch Tinker Creek Interceptor. The wastewater is dosed with ferric chloride for chemical phosphorus removal. Preliminary facilities for the wastewater influent consist of four mechanical bar screens and three parallel aerated grit chambers. Solids from the grit chamber are dewatered by inclined rakes and collected for landfill disposal. An 8 million-gallon and 24 million-gallon equalization basin, which function in series, provide surge suppression and flow equalization. Flow to the 24 million-gallon equalization basin is chlorinated when the flow begins to spill over the 8 million-gallon basin. Sludge is generally removed from the equalization basin once a year and routed to the gravity thickener.

Primary Treatment -- After passing through the aerated grit chambers, the flow is split between nine primary rectangular clarifiers to remove floating settleable solids. Chain and flight-type collector mechanisms convey solids to the sludge hopper for removal. Primary effluent is sent to a single stage activated sludge treatment system.

Secondary Treatment -- The wastewater is distributed between 16 parallel activated sludge basins with submerged aeration diffusers. Primary effluent from clarifiers 1 through 3 flows to aeration basins 1 through 6, primary effluent from primary clarifiers 4 through 6 flows to aeration basins 7 through 10, and primary effluent from primary clarifiers 7 through 9 flows to aeration basins 11 through 16. Return sludge is introduced at the head of the basins. From the aeration basins, the wastewater flows into 16 square and 2 circular secondary clarifiers. The sludge return system is operated as a three train system. Return sludge from clarifiers 1 through 6 is pumped separately to aeration basins 1 through 6. Return sludge from clarifiers 7 through 10 is pumped to 1 through 6. Return sludge from clarifiers 11 through 16 is pumped to aeration basin 11 though 16. Return sludge from clarifiers 17 and 18 is pumped to aeration basins 7 through 10.

Tertiary Treatment -- Wastewater from the secondary clarifiers flows to the pretreatment system prior to filtration. This tertiary system consists of two rapid mix tanks where ferric chloride is added to precipitate additional phosphorus, four flocculation tanks with vertical mixers, and four square coagulation settling basins. Polymer is added as a pre-filter aid. Sludge is collected through telescoping valves and can be pumped to either the gravity thickeners or dissolved air flotation thickeners (DAFs). Wastewater from the settling basins flows through ten parallel monomedia filters.

Disinfection/ Post Aeration -- Tertiary effluent is disinfected with liquid hypochlorite in two parallel chlorine contact tanks. Effluent is dechlorinated using liquid sodium bisulfite. The dechlorinated wastewater is aerated by several rows of fine membrane bubble diffusers that are supplied air by three blowers and controlled by the dissolved oxygen concentration in the effluent. Following aeration, the effluent is discharged into the Roanoke River. The permittee is currently constructing additional chlorine contact basins and a new pump station for the biological aerated filters (BAFs). These modifications will address wet weather flows from the equalization basins.

Sewage Sludge Treatment

According to the reissuance application, the Western Virginia Water Authority WPCP generates approximately 10,406 dry metric tons of sludge per year and receives approximately 41 dry metric tons of sludge per year from twelve facilities. Following treatment, this sludge is land applied to fields in Bedford and Franklin Counties.

Primary sludge is discharged to two gravity thickeners. Depending on flow, the coagulated sludge from phosphorus removal is routed to either the gravity thickeners or the DAFs. Secondary effluent is added to maintain aerobic conditions in the thickener. The sludge is allowed to settle and compact, and the thickened sludge is withdrawn from the bottom of the tank. The thickeners remove approximately one half to one fifth of the water.

Secondary sludge from the first stage solids of the activated sludge clarifiers and second stage solids from the nitrification clarifiers are pumped to the dissolved air flotation (DAF) thickener. Generally, conventional sludge and nitrification sludge are sent to separate DAF units. Pressurized effluent from the nitrification settling basin is mixed with the sludge which causes the sludge to rise to the top where the sludge is skimmed off. Some of the sludge settles to the bottom of the basin and is removed with

scraper equipment. The DAF thickeners remove approximately one fifth to one eighth of the water. At the time of the site visit, five primary digesters and two secondary digesters were operational.

Thickened sludge from the gravity thickeners and the DAF is pumped to seven primary anaerobic digesters. This anaerobic digestion process produces a Class "B" biosolids in accordance with 40 CFR Part 503. The primary digesters reduce the volatile solids. In small batches the contents of the primary digesters are transferred to the three secondary digesters. The sludge in the secondary digesters is allowed to stratify and the clear supernatant is transferred back to the head of the plant. The compacted sludge is discharged to one of five lagoons. The lagoons are decanted as needed to assist in thickening for approximately 9 months. Then, the lagoons are mixed and loaded on trucks and hauled to farmland for land application. At the time of the site visit, sludge was being discharged into lagoon #4. Lagoons #1 and #3 was covered with sludge and some vegetation. The permittee reported that there continues to be a burrowing animal removal program associated with the sludge lagoons.

Bypass Points

There are two bypass points at the facility. The bypass point associated with the influent pump station (outfall 010) would only discharge in the event of a catastrophic flood. The emergency overflow from the equalization basin (outfall 003) is chlorinated.

Storm Water Outfalls

Three storm water outfalls were identified at the facility. Storm water outfalls are associated with the ferric chloride/ ferrous chloride storage area, petroleum storage areas, septage storage area, digested sludge area, polymer and lime storage areas (outfall 011); biological aerated filter (BAF) treated wastewater area, digested sludge area, and sodium hypochlorite storage area (outfall 008); and digested sludge storage area and motor oil storage area (outfall 009). Outfall 011 contains a drop box with a value for manual discharges. During the permit term there have been no discharges from this outfall. Outfall 008 has been disconnected during construction of the chlorine contact basins. It is expected to be out of service for approximately two years.

Industrial Wastewater Contributors to WVWA WPCP

Industrial User	Principal Products	Process Flow Rate (gpd)	Non-process Flow Rate (gpd)
Accellent Cardiology	microtubing and fine wire for medical devices	750	920
Advanced Metal Finishing	electro, hydro pneumatic devices	--	--
Akzo Nobel	solvent-based coating , water-based coatings	--	--
Allied Tool	electrical cabinets, panels, solving, brackets	138	40
ALSCO Incorporated	commercial laundry	44354	840
Aramark Uniform Service	industrial laundry	34,758	1,800
Carilion Laundry Service	hospital laundry	57,009	1,380
CEI-Roanoke	cosmetics and skin care	11,895	3,249
Carilion Roanoke Memorial Hospital	hospital	23,931	134,438
Coca-Cola Bottling Company Consolidated	soft drinks	76,896	4,000
Carvins Cove Water Filtration Plant	drinking water	300,325	260
Dynax America Corporation	steel friction/mating plates	189,474	11,580
Eagle Truck Wash	truck wash	2,100	160
Excelis Incorporated	nigh vision goggles and electronic crystal catho	65,000	67,100
Freight Car America	steel and aluminum freight cars	1,500	6,000
General Electric	electrical equipment	21,100	20,000
Graham White Manufacturing Company	air dryers, pneumatic and electropneumatic valves, air gauges, brake components	3,000	3,800
Koppers Industries, Inc.	railroad ties	28,140	3,700
Lebanon Seaboard Corporation	iron chelation with citric acid for plant care	5,120	60
Lewis Gale Hospital	hospital	65,000	33,000
Maple Leaf Bakery	baked good	36,500	8,000
Medeco Security Locks Inc.	security locks	4,120	2,560
Metalsa	steel frame rails for metal trucks	45,700	4,900
Norfolk Southern Railway - East End Shops	locomotive repair/ maintenance	205,600	3,340
Norfolk Southern Railway - Shaffers Crossing	locomotive maintenance	41,330	8,130
New Millenium Building Systems	steel joists, joist girders	1,400	900
Novozymes, 111 Kessler Mill Drive, Salem	cleaning, wastewater treatment/ aquaculture products	24,600	1,175
Novozymes, 528 Chapman Street, Salem	cleaning, wastewater treatment/ aquaculture products	12,600	0
Novozymes, 528 Chapman Street, Salem	fermentation, formulation and packaging of microbes	535	40
Novozymes, 420 Kessler Mill Drive, Salem	cleaning, wastewater treatment/ aquaculture products	2,830	180
Novozymes, 620 Chapman Street, Salem	fermentation, formulation and packaging of microbes	180	105
Pepsi-Cola Bottling Company	soft drinks	41,300	2,000
Precision Fabrics Group Inc.	synthetic nylon, polyester film yarn	62,540	4,700
Precision Steel Manufacturing Corp.	custom metal fabrication	100	900
Salem Water Filtration Plant	drinking water	133,100	260
Virginia Transformer Corporation	electrical transformers	4,000	1,200
Veterans Administration Medical Center	hospital , laundry	0	136,000
Yokohama Tire Corporation	tires	58,800	14,250
Total Flows		1,605,725	480,967

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr
Secretary of Natural Resources

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David K. Paylor
Director

Steven A. Dietrich
Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
AMENDMENT TO
SPECIAL ORDER BY CONSENT
ISSUED TO
THE WESTERN VIRGINIA WATER AUTHORITY

SECTION A: Purpose

This is an Amendment to a Consent Special Order issued under the authority of Va. Code §62.1-44.15(8a) by the State Water Control Board to the Western Virginia Water Authority, for the purpose of revising certain provisions of the Consent Special Order issued by the State Water Control Board on March 18, 2005.

SECTION B: Basis for Amendment

1. Under a Consent Order issued by the Board to the Authority on March 18, 2005 ("2005 Order"), the Authority is required to perform certain improvements to the Plant and to evaluate and correct inflow and infiltration in the collection system.

2. Paragraph 2.e of Appendix A of the 2005 Order requires the Authority to complete a project for prevention of overflows in the Garst Mill Park area of the County by July 30, 2007. In a letter dated March 10, 2006, the Authority stated that it has become apparent that the Garst Mill project will be much larger than was anticipated at the time the 2005 Order was issued, with replacement of approximately 2.5 miles of primary interceptor at a cost of $10 to $12 million. The letter also stated that the project is not expected to be completed until July 2008.

3. Paragraph 3 of Appendix B of the 2005 Order provides interim effluent limits that apply during construction of improvements at the Plant. In its March 20, 2006 letter, the Authority explained that one of the improvements is conversion of a two-stage biological process to a single stage process. This conversion would require a start-up period during which it may not be possible to comply with the Permit's spring/summer effluent limitations for Total Kjeldahl Nitrogen (TKN). The Authority requested that the October

to March TKN limit specified in the Permit be applied for a period of 30 days after the start-up date for the single stage process.

4. The Permit was modified on May 24, 2006. The total suspended solids concentration discharge limitations in the modified Permit were changed as follows: Monthly Average from 2.5 mg/l to 5.0 mg/l; Weekly Average from 5.0 mg/l to 10 mg/l.

5. During construction of upgrades required under the 2005 Order, the Authority anticipates some transient construction-related events that could increase chlorine demand to the point where the internal Total Chlorine Residual ("TRC") concentration (Parameter No. 157) at the outlet of the chlorine contact tank could be less than the required 0.5 mg/l. To address this situation during construction, the Authority has requested that: 1) it be allowed to sample for *E. coli* immediately after obtaining results that show a TRC excursion in order to determine whether the wastewater at that stage of treatment meets the *E. coli* standard specified in the Permit; and 2) that a TRC excursion that is followed by a sample in compliance with the *E. coli* standard will not be considered a violation of the Permit.

6. Appendix E of the 2005 Order specified interim limits for Fecal Coliform. That limit was a typographical error carried forward from an older version of the Permit. The correct parameter, as specified in the Permit, is *E. coli*, and the correct effluent limitation is a monthly average of geometric mean of 126 colonies/100 ml, taken with a frequency of 1/Day by grab sample.

7. Therefore, it is appropriate to amend the 2005 Order to extend the deadline for completion of the Garst Mill project to July 31, 2008, to allow application of the October to March effluent limit specified in the Permit for TKN to apply for a period of 30 days after the start-up of the new single stage biological process at the Plant, to add supplemental conditions to the internal total residual chlorine limitations, to modify the interim limits for Total Suspended Solids concentration to conform to the limits specified in the modified Permit, and to correct the typographical error in Appendix E of the 2005 Order regarding the *E. coli* effluent limitation.

SECTION C: Agreement and Order

Accordingly, the State Water Control Board, by virtue of the authority granted it in Code §62.1-44.15(8a), orders the Authority and the Authority agrees that: 1) the deadline for completion of the Garst Mill project as specified at Paragraph 2.e of Appendix A of the 2005 Order is hereby extended to July 31, 2008; and 2) the Authority shall perform the actions described in Appendix A of this Amendment, which supplements the interim limits requirements for TKN at Paragraph 3 of Appendix B of the 2005 Order, conforms the Total Suspended Solids interim concentration limits specified at Appendix E of the 2005 Order to those of the recently modified Permit, supplements the internal TRC effluent limitations and monitoring requirements specified at

Section I.B.2 of the Permit, corrects a typographical error in Appendix E of the 2005 Order, and modifies the requirements regarding donations for water quality improvement at Paragraph 7 of Appendix A of the 2005 Order. Both the State Water Control Board and the Authority understand and agree that this Amendment does not alter, modify, or amend any other provision of the 2005 Order and that unmodified provisions of the 2005 Order remain in effect by their own terms.

And it is so ORDERED this day of 12-15, 2006.

Steven A. Dietrich

Steven A. Dietrich, Regional Director
West Central Regional Office
Department of Environmental Quality

The Western Virginia Water Authority voluntarily agrees to the issuance of this Amendment.

By: Michael T. McEvoy

Date: 10/2/06

Commonwealth of Virginia

City/~~County~~ of Roanoke

The foregoing instrument was acknowledged before me this 2nd day of October, 2006,

by Michael T. McEvoy, who is Executive Director Wastewater Services of the Western Virginia Water Authority, on behalf of said Authority.

Jean M. Thurman

Notary Public

My commission expires: 6/30/2010

APPENDIX A

1. The Authority shall notify DEQ, in writing, of the date of the conversion and start-up of the two stage biological process at the Plant into a single stage process within ten days of the completion of the conversion and start-up. For a period of thirty days after the start-up date of the single stage process, the Authority shall comply with the October to March Total Kjeldahl Nitrogen (TKN) effluent limit specified in the Permit. Should that 30-day start-up period span two DMR reporting periods, the October to March TKN limit shall apply to both periods.

2. The Interim Effluent Limitations specified in Appendix E of the 2005 Order for Total Suspended Solids are changed as follows: the Monthly Average Discharge Limitation for Total Suspended Solids shall be 5.0 mg/l and the Weekly Average Discharge Limitation for Total Suspended Solids shall be 10 mg/l. Unless otherwise particularly indicated herein, all other interim effluent limitations remain as specified in the 2005 Order.

3. The Total Residual Chlorine Limitations and Monitoring Requirements specified at Part I.B.2 of the Permit are supplemented as follows: An *E. coli* sample (Parameter No. 120), collected at the outlet of the chlorine contact tank within fifteen (15) minutes following any internal Total Residual Chlorine (Parameter No. 157) excursion, that results in less than 126 colonies/100 ml will be considered as in compliance with the 0.5 mg/l minimum internal Total Residual Chlorine concentration requirement.

4. The typographical error in Appendix E of the 2005 Order described at Paragraph B.6 above is corrected as follows: Instead of an effluent limit for Fecal Coliform, Appendix E shall have a limit for *E. coli* of 126 colonies/100 ml (Parameter No. 120; monthly average; geometric mean; frequency of 1/Day; grab sample).

5. Paragraph 7 of Appendix A of the 2005 Order is replaced by the following: "Beginning on or before July 10, 2005, the Authority shall donate a total of at least $5,000 annually for three years to one or more responsible local organizations or agencies to fund one or more of the following projects in the Smith Mountain Lake watershed: Best Management Projects for nonpoint source water pollution reduction; invasive species study or control project where removal of the invasive species that is the subject of the project would improve water quality; Roanoke Log Perch habitat improvements; stream restoration."

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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Robert G. Burnley
Director

Steven A. Dietrich
Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
SPECIAL ORDER BY CONSENT
ISSUED TO
THE WESTERN VIRGINIA WATER AUTHORITY
FOR
THE ROANOKE REGIONAL WATER POLLUTION CONTROL PLANT
VPDES Permit No. VA0025020

SECTION A: Purpose

This is a Consent Special Order issued under the authority of Va. Code §62.1-44.15(8a) by the State Water Control Board to the Western Virginia Water Authority ("Authority"), for the purpose of resolving certain alleged violations of State Water Control Law and the Regulations. This Order recognizes the recent creation of the Authority and the transfer of the Plant as well as the City and County sewage collection and transmission systems ("Collection System") and the associated transfer of VPDES Permit No. VA0025020 to the Authority. To facilitate the implementation of infrastructure and operational enhancements, this Order establishes new requirements for evaluation of the Authority's sewage collection and transmission systems. New requirements include identifying sources of I&I that lead to system overflows and Plant bypasses, prioritizing and implementing interim actions to reduce I&I, developing and implementing a long-term corrective action plan including I&I reduction and increased conveyance and treatment capacity, and performing those actions on an approved schedule.

SECTION B: Definitions

1. "Va. Code" means the Code of Virginia (1950), as amended.

2. "Board" means the State Water Control Board, a permanent citizens' board of the Commonwealth of Virginia as described in Va. Code §§ 62.1-44.7 and 10.1-1184.

3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.

4. "Director" means the Director of the Department of Environmental Quality.

5. "Order" means this document, also known as a Consent Special Order.

6. "Plant" means the Western Virginia Water Authority Water Pollution Control Plant, formerly known as the Roanoke Regional Water Pollution Control Plant, which operates under VPDES Permit No. VA0025020.

7. "WCRO" means the West Central Regional Office of DEQ, located in Roanoke, Virginia.

8. "Permit" means VPDES Permit No.VA0025020, which was reissued to the City of Roanoke to operate the Roanoke Regional Water Pollution Control Plant on May 14, 2004 and transferred to the Authority on July 21, 2004.

9. "Regulations" means the VPDES Permit Regulation, 9 VAC 25-31-10 *et seq.*

10. "Inflow and Infiltration" or "I&I" means non-sewage waters entering the sanitary sewer system.

11. "Bypass", as defined at 9 VAC 25-31-10, means the intentional diversion of waste streams from any portion of a treatment facility.

12. "Overflow" means a discharge of wastewater from a sanitary sewer collection or transmission system caused by hydraulic overload or maintenance problems.

13. "City" means the City of Roanoke, Virginia.

14. "County" means the County of Roanoke, Virginia.

15. "CAP" means the Corrective Action Plan required under Paragraph 4 of Appendix A herein.

16. "Contract A" means wet weather improvements including, but not limited to, construction of a new influent pumping structure, new wastewater screening structure, grit basins and new grit classifiers, primary clarification improvements including construction of three new clarifiers, new chemical feed facilities for disinfection and phosphorus removal, and all required and associated work as described in the specifications and shown on the drawings.

17. "Contract B" means process train improvements including, but not limited to, work to convert the existing two-stage activated sludge process to a single-stage activated sludge process, upgrade of the existing clarifiers and RAS pump stations, construction of new secondary clarifiers and RAS pump station, effluent filter modifications, construction of a new filter bypass structure, DAF building modifications, anaerobic digester modifications, a new waste gas burner, a new boiler building, yard piping, sitework, flood protection

improvements, miscellaneous plant improvements, and all required and associated work as described in the Specifications and shown on the Drawings.

SECTION C: Findings of Fact and Conclusions of Law

1. The Authority was formed pursuant to the Virginia Water and Waste Authorities Act, Va. Code § 15.2-5100 *et seq.*, on March 3, 2004 by the City and the County for the purpose of managing water and wastewater for the City, the County, and other local users. Title to certain assets of the City and County, including the Plant and the Collection System was transferred to the Authority on July 1, 2004. Approval for the transfer of VPDES Permit No. VA0025020 was granted by DEQ on July 21, 2004.

2. The Plant provides advanced treatment for wastewater generated by citizens, businesses and institutions in the City of Salem, the Town of Vinton, and Botetourt County (collectively, the "Localities") as well as in the City and County. Wastewater is collected in each of these jurisdictions and conveyed to the Plant by means of the Localities' satellite sanitary sewer collection and transmission systems and the Authority's Collection System.

3. The Plant and the Collection System are jointly used by the Authority and the Localities pursuant to the 2003 Regional Wastewater Collection and Treatment Contract dated November 1, 2003, which establishes the rights and obligations of the parties with respect to the use of the aforementioned facilities.

4. I&I is believed to be occurring in some of the portions of the satellite collection system owned and operated by the Localities as well as the Collection System owned and operated by the Authority. It is further believed that I&I leads to overflows in the Collection System and it is also believed to be a significant contributing factor to bypasses and VPDES Permit effluent limit violations at the Plant.

5. The City, in cooperation with the Board and DEQ, has made significant progress over the past decade in addressing I&I in the collection system, thereby reducing hydraulic overloading of the Plant, collection system overflows, and Plant bypasses. The most significant progress has been in the area of reducing wet weather overflows within that portion of the collection system located within City limits. The City and its partner jurisdictions have invested more than $90 million in undertaking capital projects. This effort has been guided by a series of consent special orders issued by the Board, which are described in paragraphs 6 through 9 below.

6. On October 3, 1990, the Board issued a Consent Order to the City to address flows to the Plant in excess of 95% of design. The 1990 Order included provisions for I&I reduction which, among other things, required completion of storm drain construction and smoke testing to confirm the absence of combined sewer connections in Roanoke's Williamson

Road area; obtaining written agreements with the County, City of Salem, the Town of Vinton, Botetourt County regarding funding and implementation of I&I programs for those localities; and development of a systemwide I&I identification and correction program.

7. On August 10, 1992, the Board issued a Consent Order to the City that superceded the 1990 Order. The 1992 Order was issued to address continuing collection system overflows, continuing flows at the Plant in excess of 95% of design, and violations of the Permit and an EPA administrative order which required implementation of a pretreatment program. The 1992 Order included provisions for I&I reduction, which, among other things, again required that Roanoke implement a system-wide I&I identification and correction program to reduce flows to the Plant to less than 35 MGD. A list of prioritized projects to be completed under the I&I program was to be submitted by December 1992. One of the projects resulted in the replacement of the Tinker Creek Interceptor.

8. On April 30, 1997, the 1992 Order was amended to address violations of Permit effluent limits caused by high Plant flows. The 1997 Amendment recognized that while certain I&I work had been performed, flows to the Plant could not be reduced below 35 MGD with I&I reduction alone. Accordingly, the 1997 Amendment included interim loading limits and a requirement to increase the capacity of the Plant from 35 to 62 MGD.

9. On December 10, 1999, the Board issued a fourth order. The 1997 Amendment stated that both it and the 1992 Order would expire upon reissuance of the Permit. Because the Permit was reissued in February 1999, the 1992 Order and the 1997 Amendment expired on that date. Because the I&I reduction projects and the Plant upgrade required by the 1997 Amendment had not been completed as of the time the Amendment expired, the 1999 Order reinstated the interim effluent limits and revised the schedules for completion of the requirements of the 1997 Amendment.

10. Although upgrades to the Plant were completed as of the deadline in the 1999 Order, the upgrades did not result in the expected increase in Plant capacity to 62 MGD. Due in part to the outcome of the Plant upgrade completed in 2000 and notwithstanding the completion of the I&I reduction projects under the above-referenced consent orders, the Plant has experienced and continues to experience bypassing and exceedences of effluent limits during wet weather events. Moreover, the Collection System has experienced and continues to experience overflows. It is recognized that the Collection System response in wet weather events is not unique to the Western Virginia Water Authority wastewater system as utilities both in the Commonwealth and nationally seek to address wet weather issues.

11. On July 8, 2002, the Board issued a Consent Order to the City ("2002 Order") to address bypasses and Permit effluent limit exceedences at the Plant. Because the Plant upgrade completed under the 1997 Amendment did not provide the expected increase in treatment

capacity, the 2002 Order required: a) commencement of additional upgrades to the Plant, including improvements in both capacity and equalization; b) disinfection of bypasses; c) evaluation of flow meters in the collection system, and d) upgrade of existing meters or installation of new meters in accordance with the findings of the evaluation, in order to provide information on sources of I&I within the collection system. The 2002 Order did not otherwise address I&I problems.

12. On December 10, 2002, the Department issued Warning Letter ("WL") No. W2002-12-W-1005 to the City. The WL referenced overflows in the City's portion of the Collection System (estimated at 1,000 to 1,500 and 500 gallons, respectively) that had occurred on September 11 and 14, 2002.

13. On February 21, 2003, the Department issued WL No. W2003-02-W-1008 to the City. The WL referenced overflows in the City's portion of the Collection System (estimated at 2000 and 200 gallons, respectively) that had occurred on December 13 and 27, 2002.

14. On April 3, 2003, the Department issued Notice of Violation ("NOV") No. W2003-04-W-0002 to the City. The NOV referenced an overflow in the City's portion of the Collection System (estimated at 3,000 gallons) that had occurred on February 6, 2003 as well as a violation of a pH Permit effluent limit that occurred in March 2003.

15. On July 15, 2003, DEQ issued NOV No. W2003-07-W-0002 to the City. The NOV alleged that the City had failed to comply with the flow metering evaluation and upgrade requirements of the 2002 Order. The NOV also alleged that the City had violated effluent limits at the Plant for chlorine in February 2003 and for Total Suspended Solids ("TSS") in October 2002.

16. On August 8, 2003, the Department issued NOV No. W2003-08-W-0004 to the City. The NOV referenced a total of eight overflows in the City's portion of the Collection System, ranging in estimated volume from 1,500 gallons to 20 gallons, that had occurred during the week of June 16th, 2003 and the week of June 23rd, 2003. The NOV also alleged that the City did not report the overflows as required by its Permit.

17. On September 10, 2003, the Department issued NOV No. W2003-09-W-0005 to the City. The NOV listed an overflow of approximately 100 gallons on July 2, 2003 and an overflow in City's portion of the Collection System of unknown quantity that occurred on July 7, 2003. The NOV also cited a violation for the month of July 2003 of the Total Kjeldahl Nitrogen ("TKN") maximum limit specified in the Permit.

18. On October 8, 2003, the Department issued NOV No. W2003-10-W-0005 to the City. The NOV alleged that the City had violated effluent limits at the Plant for pH and TKN in August

2003.

19. On November 12, 2003, the Department issued NOV No. W2003-11-W-0007 to the City. The NOV alleged that the City had not submitted a complete application for Permit reissuance by the deadline specified in the VPDES Permit Regulation.

20. On December 10, 2003, the Department issued NOV No. W2003-12-W-0005 to the City. The NOV alleged that the City had violated effluent limits at the Plant for Phosphorus in October 2003. The NOV also referenced overflows in the City's portion of the Collection System of 400 and 100 gallons respectively, that occurred on October 2 and October 17, 2003.

21. On January 8, 2004, the Department issued NOV No. W2004-01-W-005 to the City. The NOV listed an overflow in City's portion of the Collection System of approximately 50 gallons that occurred on November 11, 2003 and an overflow in the City's portion of the Collection System of approximately 10,000 gallons that occurred on November 19, 2003.

22. On October 8, 2004, the Department issued NOV No. W2004-10-W-0001 to the Authority. The NOV listed overflows, effluent limit violations, and reporting violations that occurred in August 2004.

23. On November 16, 2000, the Department issued WL No. 00-11-WCRO-008 to the County. The WL listed overflows in the City's portion of the Collection System that had occurred on July 30 (two discharges estimated at 75,000 and 60,000 gallons) and July 31, 2000 (one discharge estimated at 40,000 gallons).

24. On April 25, 2001, the Department issued WL No. 01-04-WCRO-006 to the County. The WL listed two overflows, each estimated at 90,000 gallons, in the City's portion of the Collection System that had occurred on September 1, 2000.

25. On July 9, 2001, the Department issued WL No. 01-07-WCRO-002 to the County. The WL listed two overflows estimated at 84,000 and 3,000 gallons in the City's portion of the Collection System that had occurred on April 1, 2001.

26. On August 8, 2003, the Department issued WL No. 03-08-WCRO-011 to the County. The WL listed overflows in the County's portion of the Collection System that occurred on June 14 (approximately 51,000 gallons), June 16 (six discharges estimated at 60,000, 365,000, 90,000, 45,000, 18,000, and 50,000 gallons), June 19, 2003 (three discharges estimated at 45,000, 30,000, and 15,000 gallons).

27. On September 12, 2003, the Department issued WL No. 03-09-WCRO-005 to the County.

The WL listed four overflows in the County's portion of the Collection System that occurred on July 2, 2003. Estimated volumes of these overflows were 288,000, 84,000, 16,500, and 9,000 gallons.

28. On November 14, 2003, the Department issued WL No. 03-11-WCRO-002 to the County. The WL listed an overflow in the County's portion of the Collection System of approximately 1,050 gallons that occurred on September 26, 2003.

29. On January 8, 2004, the Department issued NOV No. 04-01-WCRO-003 to the County. The NOV listed an overflow in the County's portion of the Collection System of approximately 72,000 gallons that occurred on November 19, 2003.

30. On April 14, 2004, the Department issued NOV No. 04-04-WCRO-003 to the County. The NOV listed three overflows in the County's portion of the Collection System of approximately 9,000, 6,000, and 840 gallons that occurred on February 6, 2004.

31. On May 18, 2004, the Department issued NOV No. 04-05-WCRO-011 to the County. The NOV listed an overflow in the County's portion of the Collection System of unknown volume that occurred on March 8, 2004.

32. On June 7, 2004, the Department issued NOV No. 04-06-WCRO-005 to the County. The NOV listed overflows that occurred in the County's portion of the Collection System on March 8, 2004 (unknown volume), April 13, 2004 (three overflows estimated at 1,500 gallons, 48,000 gallons, and 76,500 gallons), and April 19, 2004 (estimated at 2,000 gallons).

33. Va. Code § 62.1-44.5.A and 9 VAC 25-31-50.A prohibit the discharge of sewage or other wastes into State waters, by any person, except in compliance with a certificate or permit issued by the Board. Va. Code § 62.1-44.31 states that "[I]t shall be unlawful for any owner to fail to comply with any special order adopted by the Board....". Va. Code § 62.1-44.3 defines "person" to include any governmental body. Va. Code § 62.1-44.3 defines "owner" to include any political subdivision of the Commonwealth that owns a facility that has the capability to alter the physical, chemical, or biological properties of State waters or "discharge into state waters sewage, industrial wastes, or any noxious or deleterious substance" in contravention of § 62.1-44.5. Accordingly, prior to the transfer of the Plant and the Collection System to the Authority, the City and the County were both an owners and persons as defined by the Code. Subsequent to such transfer, the Authority is both an owner and a person as defined by the Code. The Authority has agreed to assume, and with this Order, settle the liability of the City and the County, respectively, for the violations alleged herein.

34. Since issuance of the 2002 Order, the Authority has developed a comprehensive program for

addressing overflows in the Collection System. Accordingly, this Order addresses the conditions described above by establishing a program to further reduce I&I and to further upgrade the Plant. Reduction of I&I will act to further minimize overflows in the Collection System, and, during the period of Plant upgrade will minimize Plant bypasses and Permit effluent limit exceedences. Completion of the Plant upgrade will improve the consistency of compliance with Permit effluent limits and reduce Plant bypasses.

35. On September 30, 2004, the Authority submitted a plan and schedule to DEQ for dissemination of public information regarding the inappropriateness of unauthorized sump pump, roof, and building drain connections.

36. Since issuance of the October 8, 2004 NOV to the Authority, other collection system overflows, including overflows from the Tinker Creek Interceptor and the Garst Mill Interceptor, Plant overflows and bypasses, and permit violations have occurred and have been reported by the Authority to DEQ.

SECTION D: Agreement and Order

By virtue of the authority granted it pursuant to Va. Code §62.1-44.15, the Board orders the Authority, and the Authority agrees, to perform the actions described in Appendix A, Appendix B, Appendix C, Appendix D, and Appendix E of this Order.

SECTION E: Administrative Provisions

1. The Board may modify, rewrite, or amend the Order with the consent of the Authority, for good cause shown by the Authority, or on its own motion after notice and opportunity to be heard.

2. This Order only addresses and resolves the issues specifically identified herein. This Order shall not preclude the Board or the Director from taking any action authorized by law, including but not limited to: (a) taking any action authorized by law regarding any additional, subsequent, or subsequently discovered violations; (b) seeking subsequent remediation of the Plant and/or the Collection System as may be authorized by law; or (c) taking subsequent action to enforce this Order. This Order shall not preclude appropriate enforcement actions by other federal, state, or local regulatory authorities for matters not addressed herein.

3. For purposes of this Order and subsequent actions with respect to this Order, the Authority admits the jurisdictional allegations in this Order, but does not admit the factual allegations or legal conclusions contained herein. The Board and the Authority agree that the actions undertaken by the Authority in accordance with this Order do not constitute an admission of any liability by the Authority. The Authority does not admit, and retains the right to

controvert in any subsequent proceedings other than proceedings to implement or enforce this Order, the validity of the Findings of Fact and Conclusions of Law contained in Section C of this Order.

4. The Authority declares that it has received fair and due process under the Administrative Process Act, Va. Code §§ 2.2-4000 *et seq.* and waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board or the Director to enforce this Order.

5. Failure by the Authority to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or the Director as a result of such violations. Nothing herein shall affect appropriate enforcement actions by any other federal, state, or local regulatory authority.

6. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

7. The Authority shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or other such occurrences beyond the Authority's control. The Authority shall show that such circumstances were beyond its control and not due to a lack of good faith or diligence on its part. The Authority shall notify the WCRO Regional Director in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of this Order. Such notice shall set forth: (a) the reasons for the delay or noncompliance; (b) the projected duration of any such delay or noncompliance; (c) the measures taken and to be taken to prevent or minimize such delay or noncompliance; and (d) the timetable by which such measures will be implemented and the date full compliance will be achieved. Failure to so notify the WCRO Regional Director within seventy-two hours of learning of any condition above, which the parties intend to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order.

8. This Order is binding on the parties hereto, their successors in interest, designees and assigns, jointly and severally.

9. This Order shall become effective upon execution by both the Director or his designee and the Authority. Notwithstanding the foregoing, the Authority agrees to be bound by any compliance date that precedes the effective date of this Order.

10. Any plans, reports, schedules or specifications attached hereto or submitted by the Authority and approved by the Department pursuant to this Order are incorporated into this Order. Any non-compliance with such approved documents shall be considered a violation of this Order.

11. This Order shall supercede the 1999 Order, which is hereby terminated, and shall continue in effect until either: a) the Authority petitions the Director or his designee to terminate the Order after it has completed all of the requirements of the Order and the Director or his designee approves the termination of this Order, or b) the Director or Board terminates this Order in his or its sole discretion upon 30 days written notice to the Authority. Termination of this Order, or any obligation imposed in this Order, shall not operate to relieve the Authority from its obligations to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

12. By the signature of an authorized official below, the Authority voluntarily agrees to the issuance of this Order.

13. The undersigned representative of the Authority certifies that he or she is a responsible official authorized to enter into the terms and conditions of this Order and to execute and legally bind the Authority to this document. Any documents to be submitted pursuant to this Order shall also be submitted by a responsible official of the Authority.

And it is so ORDERED this 18th day of MARCH, 2005.

Steven A. Dietrich
FOR Robert G. Burnley, Director
Department of Environmental Quality

The Western Virginia Water Authority voluntarily agrees to the issuance of this Order.

By: Michael W. Altizer
Michael W. Altizer, Chair

Commonwealth of Virginia

City/~~County~~ of Roanoke

The foregoing instrument was acknowledged before me this 23rd day of December, 2004, by Michael W. Altizer, who is Chairman of the Board of the Western Virginia Water Authority, on behalf of said Authority.

Jean M. Thurman
Notary Public

My commission expires: 6-30-06

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APPENDIX A
I&I Evaluation and Corrective Action

1. Flow Monitoring. The Authority shall comply with the Flow Monitoring Plan it submitted to DEQ on July 20, 2004.

2. Initial Interim I&I Corrective Action Projects.

   a. Not later than March 31, 2005, the Authority shall complete the following repairs or replacements of its sewage collection system.

Location of Repairs	Line Size (inches)	Linear Feet of Repair Or Replacement
2424 Brambleton Ave., S.E.	8	550
3100 Block, Oaklawn Ave., N.W.	8	270
3710 Londonberry Dr., S.W.	8	390
2600 & 2700 Block Stephenson Ave., S.W.	8	450
Behind Oleva St., N.W.	8	400
Behind 4340 Plantation Rd., N.E.	8	768
3700 to 3800 Blocks, Salem Turnpike	8	400
Beginning 3313 Garst Mill Rd., S.W.	8	240

   b. Additional Interim I&I Corrective Action Projects due by 2005. Not later than March 31, 2005, the Authority shall submit to DEQ for review and approval a schedule with construction completion deadlines for interim I&I reduction projects to be performed by December 30, 2005, which upon its approval shall become a part of and enforceable under the terms of this Order.

   c. Additional Interim I&I Corrective Action Projects due by 2007. Not later than December 30, 2005, the Authority shall submit to DEQ for review and approval a schedule with construction completion deadlines for additional interim I&I reduction or line capacity projects to be performed by January 30, 2007, which upon approval shall become a part of and enforceable under the terms of this Order. This schedule shall be based on the CSES Report Outline described at Paragraph 3 below.

   d. Garst Mill Park Static Flow Model. Not later than July 30, 2005, the Authority shall submit to DEQ a static flow model of the Roanoke River Interceptor to the point of its conjunction with the Garst Mill sub-interceptor and a static flow model of the sub-interceptor serving the Garst Mill Park area of the County.

e. Garst Mill Park Corrective Action. Not later than October 30, 2005, the Authority shall submit to DEQ for review and approval a plan and schedule for prevention of overflows in the Garst Mill Park area of the County by July 30, 2007 (the "Garst Mill Plan"). Upon its approval, the Garst Mill Plan shall become a part of and enforceable under the terms of this Order.

3. Collection System Evaluation Study ("CSES") and Associated Field Activities

a. Previous Studies. Not later than March 31, 2005, the Authority shall provide to DEQ a listing and summary of previous studies and records, field reports, and other pertinent information generated from previous studies in the possession of the Authority that the Authority proposes to use in the development of the final CSES.

b. Old Roanoke River Interceptor Report. Not later than March 31, 2005, the Authority shall provide to DEQ, for its review and approval, a separate report on the condition of the sections of the old Roanoke River Interceptor still connected to the new Roanoke River Interceptor. The report shall include recommendations for future replacement or upgrade of the old Roanoke River Interceptor sections and shall prioritize these repairs, as appropriate, into two categories: (i) repairs appropriate for inclusion in the March 31, 2005 additional projects submission under Paragraph 2.b above, and (ii) repairs appropriate for evaluation and inclusion in the CAP. Upon its approval, implementation of the recommendations of said report shall become a part of and enforceable under the terms of this Order.

c. Root Control Pilot Project. Not later than March 31, 2005, the Authority shall complete a pilot project on root control and submit a written report to DEQ describing the results of the project. For a period of four years, the Authority shall submit an annual report in accordance with Paragraph 3.a of Appendix D herein describing the re-growth of roots in the pilot project area. The Authority shall utilize the results of this pilot project in the development of the Collection System Operation and Maintenance Plan required under this Appendix A.

d. River Crossing Field Investigations. Not later than March 31, 2005, the Authority shall submit to DEQ an interim report describing the results of investigations of the condition of existing Collection System river and creek crossings along the Roanoke River, Tinker Creek, Peters Creek, Lick Run, Mudlick Creek, Murray Run, Barnhart Creek, and Ore Branch. The Authority shall consider the results of these investigations in developing the submittals required under Paragraphs 2.b and 2.c above and the CAP.

e. Residential Pilot Project. Not later than March 31, 2005, the Authority shall develop and submit to DEQ for review and approval a plan and schedule for a pilot project to demonstrate reduction or elimination of I&I from house laterals, foundation/yard drains, and sump pumps connected to the Collection System. The scope of the project area shall include, at a minimum, 600 homes. The plan shall explain the rationale for the homes selected. The plan shall include provisions for flow monitoring before and after completion of I&I reduction measures in order to evaluate the effectiveness of the measures. Upon its approval the Authority shall complete the Residential Pilot Project, under the terms of this Order, by April 30, 2006. The Authority shall continue flow monitoring in Project area(s), and shall continue to submit annual flow monitoring reports, as specified at Paragraph 3.b of Appendix D herein, until DEQ informs the Authority that sufficient flow data has been reported to provide a conclusive evaluation of the effectiveness of the Project.

f. Manhole / Sewer Line Pilot Project. Not later than March 31, 2005, the Authority shall develop and submit to DEQ for review and approval a plan and schedule for a pilot project to reduce or eliminate I&I from manholes and sewer lines in a selected pilot area. The results of pilot project are anticipated to be used in the formulation of a future, system-wide project to correct manhole and sewer line deficiencies that contribute to I&I. The plan shall explain the rationale for the Project area(s) selected and shall include provisions for flow monitoring before and after I&I reduction measures, in order to evaluate the effectiveness of the measures in reducing I&I. Upon its approval, the plan and schedule shall become a part of and enforceable under the terms of this Order. The Authority shall complete the Manhole / Sewer Line Pilot Project by April 30, 2006. The Authority shall continue flow monitoring in Project area(s) and shall continue to submit annual flow monitoring reports, as specified at Paragraph 3.c of Appendix D herein, until DEQ informs the Authority that sufficient flow data has been reported to provide a conclusive evaluation of the effectiveness of the project.

g. Collection System Evaluation and Study Report Outline. Not later than January 30, 2006, the Authority shall submit to DEQ, for its review and approval, a proposed outline for the final Collection System Evaluation Study ("CSES") Report using the data and materials from significant studies of the Collection System and field activities performed prior to issuance of this Order and the results of all studies, projects, and flow metering completed as of December 30, 2005 pursuant to this Order. The CSES Report Outline shall provide adequate information to identify the primary information expected to be contained in the final CSES as well as any necessary discussion regarding activities that may be undertaken for formation of the final report. The CSES Report Outline shall describe all significant sources of I&I identified as of December 30, 2005 and

shall include a discussion of alternatives and recommendations for further I&I reduction.

h. Final Collection System Evaluation and Study Report. Not later than July 30, 2006, the Authority shall submit to DEQ, for its review and approval, a Final CSES Report describing the results of all studies, projects, and flow metering performed as of June 30, 2006. The Final CSES Report shall specify and prioritize, in view of the treatment and equalization capacity of the Plant and conveyance capacity of existing lines, recommended levels of I&I reduction in specific portions of the sewershed that would be necessary to eliminate overflows from the collection systems and/or bypasses at the Plant. If the Authority determines that there are combined sewers within the Collection System, then the Final CSES Report shall include a description of how the Authority will comply with EPA's Combined Sewer Overflow Control Policy. The Final CSES report shall include an evaluation of ongoing I&I reduction measures and/or capacity projects, existing Permit effluent limitations and requirements, and water quality objectives to identify options for further reducing bypasses from the Plant equalization basin. This evaluation shall address the benefits of increasing volumetric flow and/or modifying existing effluent limitations at outfall 001, and implementing modified wet weather operating procedures including the potential use of blending. The Final CSES Report shall also include recommended peak flows to be accepted from Botetourt County, the City of Salem and the Town of Vinton at each point at which each of these localities is connected to the Authority's Collection System.

4. Corrective Action Plan. Based upon the conclusions and recommendations of the Final CSES Report, as approved by DEQ, the Authority shall not later than January 30, 2007 submit to DEQ for review and approval a Corrective Action Plan with a prioritized schedule of completion of projects to minimize I&I-related overflows and bypasses, including system-wide implementation of any elements of Pilot Projects identified above determined to be effective in reducing I&I. The CAP shall include provisions for elimination or proper management of any peak flows from the Localities identified in the CSES Report that contribute to overflows or bypasses. The CAP shall include a justification of its priorities and a plan to finance the identified I&I elimination projects. The CAP shall consist of phases, with the first phase corresponding to the remaining term of the Permit and subsequent 5-year phases corresponding to the Permit renewal terms. Upon its review and approval by DEQ, the CAP shall become a part of and enforceable under the terms of this Order.

5. Wastewater Collection and Treatment System Program Activities.

a. Manhole Field Investigations Mapping. Not later than March 31, 2005, the

Authority shall submit to DEQ a written report describing the results of a conditions evaluation and mapping of approximately 1,000 manholes. The Authority shall consider the results of this evaluation in developing the CAP.

b. Flow Model Small Lines Report. Not later than March 31, 2005, the Authority shall submit to DEQ for review and approval a report that determines from a review of flow monitoring and other data which, if any, smaller lines (i.e. less than 15 inches in diameter) in the collection system should be included in the system-wide flow model described in Paragraph 5.c below, to develop a comprehensive plan and schedule for system-wide I&I reduction.

c. Flow Model Development. Not later than July 30, 2006, the Authority shall submit to DEQ for review and approval a system-wide model of flows from collection system lines 15 inches in diameter and above, and any smaller lines identified pursuant to the requirements of Paragraph 5.b above.

d. Collection System Map. Not later than January 30, 2006, the Authority shall provide to DEQ a Collection System map identifying the location and size of Collection System pipes, interceptors and manholes and providing a general description of the condition these system units.

e. Authority for Private Connection Management Program. Not later than July 30, 2005, the Authority shall issue or amend the appropriate legal documents that will provide the Authority with the authority to regulate private connections (such as foundation drains, sump pumps and gutters) to the Collection System equivalent to or more stringent than the authority given to the County to regulate private connections.

f. Post-Construction Desktop Evaluation of the Plant. Not later than July 30, 2006, the Authority shall submit a written report to DEQ describing the results of Desktop evaluations of the treatment capacity, including a determination of daily average influent flow capacity, of the Plant, during varying rainfall events (storm hydrographs). The evaluations shall take into account the improvements to treatment capacity expected as a result of the completion of Plant upgrade projects currently under contract. The evaluations must specify the anticipated size of bypasses at the Plant's equalization basin, necessary to prevent irreparable harm to Plant treatment units, under the varying rainfall scenarios. The rainfall scenarios to be used in the evaluations are those approved under the provisions of Paragraph 1 above. The goal of the evaluations is to define the levels of I&I reduction necessary to eliminate Plant bypasses, should no further Plant upgrades be made. The evaluations shall be utilized in the development of the CSES Report and the CAP.

6. Beginning on or before July 10, 2005, the Authority shall donate at least $5,000 annually for three years to the Tri Lake Commission to fund debris removal at Smith Mountain Lake.

7. Beginning on or before July 10, 2005, the Authority shall donate at least $5,000 annually for three years to a responsible local organization or agency to fund Best Management Projects for nonpoint source water pollution reduction in the Smith Mountain Lake watershed.

8. Beginning on or before July 10, 2005, the Authority shall donate at least $5,000 annually for three years to the Smith Mountain Lake Association for water quality monitoring on Smith Mountain Lake.

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APPENDIX B
The Plant

1. Construction. The Authority shall complete construction and apply for a Certificate to Operate the Plant capacity and equalization improvement measures specified in Contracts A and B not later than August 30, 2007.

2. Bypasses. The following conditions are applicable to bypass discharges from PS003 at the Plant:

   a. Until issuance of a CTO for the improvements contained in Contracts A and B, a bypass discharge occurring when the estimated average daily influent flow to the Plant for the previous 72 hours was less than or equal to 42 MGD, shall be deemed a violation of the Permit, unless the Authority can demonstrate that the conditions of Part II.U of the Permit and 9 VAC 25-31-190.M of the Permit Regulation have been met.

   b. Not later than March 31, 2005, the Authority shall submit to DEQ, for its review and approval, plans and specifications for modifications to existing equipment and the installation of any additional equipment necessary to ensure adequate disinfection of bypass discharges at PS003.

   c. Upon approval of the plans and specifications referenced in subparagraph 2.b above, the Authority shall complete installation and/or modification of disinfection equipment within 60 days of approval of plans and specifications by DEQ.

   d. Not later than March 31, 2005, the Authority shall submit to DEQ, for its review and approval, a Plant operation plan addressing procedures for Plant operations, including operation of disinfection equipment, immediately before, during, and immediately after bypasses at PS003. Upon its approval, said plan shall become a part of and enforceable under the terms of this Order.

   e. The Authority shall measure fecal coliform concentrations and Biochemical Oxygen Demand ("BOD_5"), TKN, Total Phosphorus ("TP"), and TSS loadings at outfall PS003 whenever bypasses occur at this location. Such measurements shall be grab samples but shall conform to the analysis requirements contained in the Permit. The Authority shall collect one sample of each parameter, per day, per bypass event. The Authority shall submit the data from these sampling efforts and the information required by the bypass-monitoring plan required by Paragraph 2.d above with the Plant's monthly Discharge Monitoring Reports unless directed otherwise by any reissuance or modification of the Permit.

3. Interim Limits (42 MGD). Effluent limitations in effect at outfall 001 until issuance of CTO for the improvements contained in Contracts A and B are as follows:

   a. The Authority shall comply with the effluent limitations specified in the Permit when the average daily influent flow at the Plant in any given month is less than or equal to 42 MGD.

   b. The Authority shall comply with the interim effluent limitations specified in Appendix E of this Order in lieu of the effluent limitations specified in the Permit when the average daily influent flow at the Plant in any given month is greater than 42 MGD.

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APPENDIX C
System-wide Planning and Management

1. Revenue. The Authority shall raise the revenue necessary to implement the approved CAP described in Appendix A hereto, within four years of CAP approval, or to the limit of its financial capabilities. The Authority shall be deemed to be raising CAP funds to the limit of its financial capability if the following criteria are met:

   a. At least bi-annually the Authority adjusts its sewer rates so that within five years of the date DEQ approves the CAP:

      (1) The annual sewer bill[1] for typical residential customers (i.e. 5,000 gallons of average monthly use) will be at least 1.25% of median household income[2] in the City; and

      (2) The sewer volume rate for customers identified as industrial users in the Authority's utility billing records will equal the rate charged to the Authority's residential customers.

   b. Beginning with the twelve month period following CAP approval, the Authority annually adjusts unobligated sewer system reserve funds to equal no more than 25% of the subsequent year's budgeted operating expenditures.

   c. Beginning with the year in which this Order is effective, the Authority shall annually seek grant and low interest loan funding for the CAP from federal, state, and other sources offering such funding for sewer or water quality improvements projects.

2. Spending. Each fiscal year following the effective date of this Order the Authority shall allocate and spend all available funds on I&I corrective action projects identified in this Order. Available funds for I&I corrective action projects shall include annual sewer revenues remaining after ordinary expenditures required to administer, operate and maintain the Collection System and the Plant in accordance with federal and state water quality related requirements, expenditures required under the CMOM Plan and capital allocations and expenditures to procure, maintain and replace capital funds and

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[1] Defined as revenue from rates, fees, assessments or charges that sewer customers must pay.

[2] As reflected in the 2000 and any subsequent census. In the years between each census, the median household income (MHI) shall be adjusted based on the percent change in the 2-year moving average for Virginia's MHI as regularly published by the U.S. Census Bureau. If that data is not available, MHI adjustments shall be based upon adjusted gross income (AGI) since the date of the last census as reflected in data published by the Virginia Department of Taxation, or, if that information is not available, the MHI shall be adjusted based on 75% of the percent increase in the consumer price index for that year.

equipment consistent with a prudent asset management program. Available funds for I&I corrective action projects also include any loan and grant funds obtained for the purpose of implementing the CAP.

3. Continuing Capacity, Management, Operation and Maintenance Program. By December 30, 2005, the Authority shall provide DEQ for review and approval, a Capacity, Management, Operation and Maintenance ("CMOM") Plan. Upon its review and approval by DEQ, the CMOM Plan shall become a part of and enforceable under the terms of this Order. The CMOM Plan shall include the following:

   a. Specification of major goals of the program;

   b. Identification of administrative and maintenance positions responsible for implementing CMOM program measures, including identification of lines of authority by organization chart or similar document and the chain of communication for reporting overflows;

   c. A description of legal authority, through sewer use ordinance, service agreements or other legally binding documents, to:

      (1) Control infiltration and connections from inflow sources;

      (2) Require that sewers and connections be properly designed and constructed;

      (3) Ensure proper installation, testing, and inspection of all new and rehabilitated portions of the Collection System;

      (4) Address flows from satellite collection systems;

   d. Identification of certain Plan elements, specifying the person or position within the Authority responsible for each element and indicating current staffing and resource commitments to carry out each element, including, but not limited to:

      (1) Maintenance of facilities and equipment;

      (2) Maintenance of a map of the Collection System;

      (3) Management of information and use of timely, relevant information to establish and prioritize appropriate CMOM activities, and identify and illustrate trends in overflows, such as frequency and volume;

      (4) Routine preventative operation and maintenance activities.

(5) A schedule of preventive maintenance activities, which shall include, but not be limited to, the following:

A. Periodic service and calibration of all instrumentation, including flow meters, liquid level sensors, alarm systems, elapsed time meters, and remote monitoring equipment;

B. Routine inspection and service of each pump station, including engines, motors, generators, pumps, wet wells, valves, and related equipment;

C. Periodic inspection and testing and, if necessary, servicing of all pumps including impellers, seals, and bearings, wear clearances, couplings, drives and motors; and

D. Routine inspection and service for mainlines sewers, manholes, siphons, and other appurtenances.

e. Design and performance provisions, which shall include, but not be limited to the following:

(1) Requirements and standards for the installation of new sewers, pumps, and other appurtenances; and rehabilitation and repair projects; and

(2) Procedures and specifications for inspecting and testing the installation of new sewers, pumps, and other appurtenances and for rehabilitation and repair projects.

f. Monitoring, measurement, and program modification provisions, which shall include, but not be limited to the following:

(1) Monitoring the implementation and measuring the effectiveness of each element of the Authority's CMOM program;

(2) Updating program elements as appropriate based on monitoring or performance evaluations;

(3) Updating the Authority's CMOM program, as appropriate, to keep it updated and accurate; and

(4) Visual observation and estimation of flows at each Collection System pump station during periods of both dry weather and wet weather to verify the continued effectiveness of the CMOM program and the continued

adequacy of the Collection System and pump stations.

g. An Overflow Emergency Response Plan that identifies measures to protect public health and the environment. The plan must include mechanisms to:

(1) Ensure that overflows (including those that do not discharge to state waters) are addressed appropriately, including ensuring that reports of overflows are immediately dispatched to appropriate personnel for investigation and appropriate response;

(2) Ensure appropriate immediate notification to the public, health agencies, other impacted entities (e.g. water suppliers) and DEQ. The CMOM program shall identify the public health and other officials who will receive immediate notification;

(3) Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained; and

(4) Provide for emergency operations.

h. If final federal CMOM regulations are promulgated after the CMOM Plan is approved, the Authority may amend the CMOM Plan to make it consistent with the applicable federal regulations.

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APPENDIX D
Quarterly and Annual Reporting Requirements

1. Quarterly Report. Beginning April 30, 2005, the Authority shall submit quarterly progress reports to DEQ. Quarterly reports shall be due on January 30, April 30, July 30, and October 30 of each year. Quarterly reports shall include the following elements:

   a. A description of progress in completing the requirements of Appendix A, Appendix B, and Appendix C of this Order, including the status of any required construction or rehabilitation projects and whether such activities are on schedule for completion within required timeframes.

   b. Flow Monitoring data collected pursuant to Appendix A, Paragraph 1 of this Order. The flow monitoring component of the quarterly report shall include:

      (1) Daily average and peak hourly flows from Authority flow monitors and existing master billing meters for Botetourt County, the City of Salem, and the Town of Vinton.

      (2) Daily readings from the groundwater level monitoring stations included in the map submitted pursuant to Paragraph 1 of Appendix A of this Order,

      (3) Daily readings from the rain gauges included in the map submitted pursuant to Paragraph 1 of Appendix A of this Order.

2. Annual Financial Report. For each fiscal year during which the Authority relies on the financial test in Paragraph 1 of Appendix C, the Authority shall by the first day of December of the next fiscal year submit an annual financial report to DEQ that includes the following elements:

   a. An independent rate consultant report that includes schedules and other material designed to demonstrate compliance with the funding and spending criteria specified at Appendix C of this Order. At a minimum, the independent rate consultant's report will include:

      (1) A schedule of sewer rates and charges in effect during the year and an explanation of any changes in the sewer rates and charges during the year;

      (2) A schedule that calculates the current year annual sewer bill for a residential customer with a 5,000 gallon average monthly sewer use and the percentage of such bill to median household income in the City;

      (3) A schedule detailing sewer related revenues, operation and maintenance

expenses, net revenues, debt service and the sewer debt service coverage ratio for the previous year;

(4) A schedule displaying the beginning balance, additions, uses and ending balance of sewer reserve funds, and a comparison (expressed as a percentage) of the year end reserve balance to the subsequent year's operating expenditure budget;

(5) A schedule detailing amounts of borrowed funds, grants, and other sources of capital funds, and the amount of capital funds obligated for sewer projects during the previous year; and,

(6) A schedule displaying the industrial rate structure and progress toward the goal of parity between industrial and residential rates.

b. An accounting of all sums expended on implementation of specific CAP projects in the previous fiscal year and in each fiscal year since the effective date of this Order.

c. An accounting of all sums obligated in the current fiscal year and funds projected to be obligated within the next five years for implementation of CAP projects.

d. A narrative report of the status of each CAP project including projected completion dates contingent upon funding availability.

e. A status report of progress being made in procuring state and federal grants and low interest loans for the purpose of implementing specific elements of the CAP.

3. Annual Pilot Projects Report. Not later than 30th day of July of each required year, the Authority shall submit an Annual Pilot Projects Report to DEQ that includes the following elements:

a. A description of re-growth of roots in the pilot project area for the Root Control Project specified at Paragraph 3 of Appendix A herein.

b. Flow monitoring data summaries and conclusions as to the effectiveness of the measures employed in the Residential Pilot Project specified at Paragraph 3 of Appendix A herein.

c. Flow monitoring data summaries and conclusions as to the effectiveness of the measures employed in the Manhole / Sewer Line Pilot Project specified at Paragraph 3 of Appendix A herein.

4. All items required to be submitted by this Order shall be submitted to the West Central

Regional Office of DEQ.

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APPENDIX E

B. INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. As specified at Appendix B, Paragraph 2 of this Order, the Authority shall comply with the effluent limitations specified in the Permit when the average daily influent flow at the Plant in any given month is less than or equal to 42 MGD. The Authority shall comply with the effluent limitations specified below when the average daily influent flow at the Plant in any given month is greater than 42 MGD.

   Such discharges shall be limited and monitored by the permittee as specified below:

	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
EFFLUENT CHARACTERISTICS	Monthly Average	Weekly Average	Minimum	Maximum	Frequency	Sample Type
Flow, (MGD)[2]	NL	NA	NA	NL	Continuous	T/I/R
pH (Standard Units)	NA	NA	6.5	9.0	1/Day	Grab
BOD_5	5.0 mg/l	7.5 mg/l	NA	NL	1/Day	24 HC
Total Suspended Solids	2.5 mg/l	5.0 mg/l	NA	NL	1/Day	24 HC
Fecal Coliform (N/100 ml)	200*	NA	NA	NL	1/Day	Grab
Dissolved Oxygen (mg/l)	NA	NA	6.0	NL	1/Day	Grab
Total Phosphorus	0.2 mg/l	0.3 mg/l	NA	NL	1/Day	24 HC
Cyanide, Total (as CN)	8.1 µg/l	10.0 µg/l	NA	NL	2D/Month	Grab
Total Kjeldahl Nitrogen (April – Sept.)	2.0 mg/l	3.0 mg/l	NA	NL	1/Day	24 HC
Total Kjeldahl Nitrogen (Oct. - March)	4.0 mg/l	5.0 mg/l	NA	NL	1/Day	24 HC
Nickel, Total Recoverable	29.6 µg/l	36.4 µg/l	NA	NL	2D/Month	24 HC
Chromium, Hexavalent	7.7 µg/l	9.5 µg/l	NA	NL	2D/Month	Grab
Mercury, Total Recoverable	0.014 µg/l	0.018 µg/l	NA	NL	2D/Month	24 HC
Selenium, Total Recoverable	5.1 µg/l	6.2 µg/l	NA	NL	2D/Month	24 HC
Total Residual Chlorine (TRC)[3]	3.1 µg/l	3.9 µg/l	NA	NL	1/Day	Grab

T/I/R = Totalizing, Indicating, Recording; NA = Not applicable; NL = No Limitation, monitoring required; 24 HC = 24 hour composite
* Geometric Mean

2. The design flow of this treatment facility is 42 MGD.
3. See Part I.B of the Permit for additional TRC limitations and monitoring requirements.
4. See Part I.C of the Permit for Quantification Levels and Reporting requirements for metals, cyanide, and TRC.
5. See Part I.G.5 of the Permit for additional monitoring requirements.
6. There shall be no discharge of floating solids or visible foam in other than trace amounts.

hh

Attachment D

USGS Topographic Map

File: V:\PROJECTS\BVA\25154\CADD\FIGURES\SITE LOCATION MAP.DWG Saved: 8/1/2013 9:04:23 AM Plotted: 8/1/2013 9:07:46 AM User: Hodge, Chris LastSavedBy: 3771

0 2000 4000
Scale in feet

CHA
1901 Innovation Drive, Suite 2100
Blacksburg, VA 24060
Main: (540) 552-5548 • www.chacompanies.com

WESTERN VIRGINIA WATER AUTHORITY
WATER POLLUTION CONTROL PLANT

SITE LOCATION MAP

PROJECT NO. 25154

DATE: 8/2013

96

Attachment E

Ambient Water Quality Data

- **Upstream pH and Temperature Monitoring Data**
- **Upstream Hardness Data**
- **Instream Dissolved Oxygen Monitoring Summary**

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	pH (S.U.
01/14/2003 09:20	8.22
02/11/2003 08:30	7.9
03/04/2003 10:00	8
04/03/2003 10:00	8.3
05/05/2003 10:00	7.9
06/19/2003 10:00	8.4
07/10/2003 14:00	7.97
09/24/2003 15:00	8.17
11/20/2003 14:30	7.57
01/22/2004 13:55	7.99
03/16/2004 15:40	7.8
05/25/2004 14:35	8.19
07/19/2004 13:50	7.67
09/30/2004 13:30	7.33
11/09/2004 15:45	8.05
01/26/2005 13:00	8.24
03/14/2005 15:20	8.01
05/24/2005 16:15	8.2
07/13/2005 12:30	8.3
09/19/2005 11:30	8.4
10/13/2005 14:00	8.1
11/28/2005 11:30	7.8
01/10/2006 12:00	8.5
03/08/2006 11:30	8.4
05/04/2006 11:00	8
07/17/2006 12:00	8.5
09/12/2006 10:00	8
11/07/2006 13:00	8.1
01/04/2007 15:30	7.9
03/13/2007 15:00	8
05/09/2007 11:00	7.7
07/10/2007 10:30	7.2
09/11/2007 12:00	7.7
11/01/2007 10:30	6.5
01/16/2008 11:00	6.6
03/03/2008 12:15	8
03/05/2008 10:30	7.5
04/07/2008 13:15	7.9
05/01/2008 11:00	8
07/07/2008 15:30	8.2
09/08/2008 15:30	8.4
11/06/2008 10:30	8.4
02/10/2009 10:30	8.5
04/06/2009 10:00	7.1
06/16/2009 14:00	8.2
08/13/2009 11:00	8.1
10/14/2009 09:30	8.1
12/15/2009 10:30	7.6
02/18/2010 10:30	8
04/15/2010 11:30	8.1
06/10/2010 11:00	8.1
08/31/2010 11:00	8.2
10/13/2010 10:00	8
12/21/2010 11:30	8

90th Percentile pH	8.4 S.U.
10th Percentile pH	7.6 S.U.

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	pH (S.U.
04/06/2011 11:30	8.7
06/15/2011 16:00	8.3
08/01/2011 10:30	8.2
10/04/2011 11:00	8.3
12/14/2011 11:00	8.2
02/09/2012 11:30	8.4
03/07/2012 11:00	7.8
05/02/2012 10:30	8.1
07/05/2012 13:00	8.2
09/24/2012 11:00	8.2
11/06/2012 11:00	8.3
01/07/2013 11:35	7.9
03/05/2013 08:55	7.9
05/30/2013 08:45	8.1
07/18/2013 09:10	7.9

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Temp Celsius
01/14/2003 09:20	2.6
02/11/2003 08:30	4.8
03/04/2003 10:00	5.8
04/03/2003 10:00	13.9
05/05/2003 10:00	13.1
06/19/2003 10:00	17.4
07/10/2003 14:00	22.6
09/24/2003 15:00	19.31
11/20/2003 14:30	11.51
01/22/2004 13:55	2.61
03/16/2004 15:40	10.9
05/25/2004 14:35	25.4
07/19/2004 13:50	22.7
09/30/2004 13:30	17.5
11/09/2004 15:45	11.31
01/26/2005 13:00	3.92
03/14/2005 15:20	9.43
05/24/2005 16:15	17.5
07/13/2005 12:30	24.9
09/19/2005 11:30	21.4
10/13/2005 14:00	19.6
11/28/2005 11:30	6.5
01/10/2006 12:00	8.7
03/08/2006 11:30	9.7
05/04/2006 11:00	17.3
07/17/2006 12:00	26
09/12/2006 10:00	19.3
11/07/2006 13:00	8.5
01/04/2007 15:30	7.5
03/13/2007 15:00	13.5
05/09/2007 11:00	17.2
07/10/2007 10:30	26
09/11/2007 12:00	25
11/01/2007 10:30	12.3
01/16/2008 11:00	4.4
03/03/2008 12:15	10.7
03/05/2008 10:30	11.3
04/07/2008 13:15	10.8
05/01/2008 11:00	14.1
07/07/2008 15:30	24.3
09/08/2008 15:30	27
11/06/2008 10:30	11
02/10/2009 10:30	8.4
04/06/2009 10:00	13.2
06/16/2009 14:00	20
08/13/2009 11:00	24.9
10/14/2009 09:30	13.1
12/15/2009 10:30	10.3
02/18/2010 10:30	5
04/15/2010 11:30	14.3

90th Percentile Temperature	24.9 °C
90th Percentile Temperature Jan. - May	17.4 °C

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Temp Celsius
06/10/2010 11:00	22.5
08/31/2010 11:00	24.5
10/13/2010 10:00	17.8
12/21/2010 11:30	2.3
02/09/2011 11:00	4.4
04/06/2011 11:30	10.7
06/15/2011 16:00	24
08/01/2011 10:30	26.6
10/04/2011 11:00	14.2
12/14/2011 11:00	9
02/09/2012 11:30	7.6
03/07/2012 11:00	8
05/02/2012 10:30	19
07/05/2012 13:00	28.7
09/24/2012 11:00	17.9
11/06/2012 11:00	8.3
01/07/2013 11:35	7
03/05/2013 08:55	5.5
05/30/2013 08:45	20.4
07/18/2013 09:10	22.3

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Hardness, Total (mg/L as $CaCO_3$)
01/21/1998 11:00	132
02/11/1998 07:15	128
03/09/1998 10:20	115
04/14/1998 10:15	128
05/26/1998 10:20	121
06/08/1998 10:00	155
07/14/1998 10:50	151
08/24/1998 10:15	223
09/23/1998 11:40	199
10/27/1998 10:15	239
11/09/1998 08:35	282
12/03/1998 10:20	214
01/05/1999 10:55	155
01/11/1999 11:30	214
02/02/1999 09:50	142
03/17/1999 10:10	124
04/14/1999 10:15	126
05/05/1999 09:00	162
06/09/1999 09:40	184
07/22/1999 09:30	106
08/11/1999 09:30	213
09/20/1999 09:00	190
11/17/1999 09:30	150
12/15/1999 10:25	134
01/25/2000 09:30	179
02/15/2000 09:45	117
03/01/2000 10:25	149
04/12/2000 09:10	136
05/18/2000 10:05	174
06/13/2000 10:40	163
07/18/2000 12:30	177
08/09/2000 13:00	175
09/19/2000 12:00	80.7
10/11/2000 12:00	180
11/09/2000 11:00	208
12/13/2000 11:00	189
01/18/2001 13:30	191
02/15/2001 11:00	173
03/19/2001 11:30	114
04/02/2001 12:00	76.3
05/01/2001 11:00	139
06/04/2001 13:00	150
07/24/2001 09:00	153
08/07/2001 09:00	173
09/10/2001 10:00	185
10/10/2001 10:30	217
11/19/2001 09:30	123
12/19/2001 09:00	167

mean	155	mg/L

VAW-L04R
4AROA202.20 (14th Street Bridge above WWTP outfall 001)

Collection Date Time	Hardness, Total (mg/L as $CaCO_3$)
01/14/2002 10:30	197
02/04/2002 09:00	188
03/11/2002 10:00	129
04/01/2002 10:00	131
05/02/2002 15:30	126
06/04/2002 08:15	179
07/30/2002 08:45	191
08/27/2002 08:50	135
09/25/2002 09:00	111
10/23/2002 09:15	191
11/19/2002 09:20	110
12/16/2002 09:30	126
01/14/2003 09:20	127
02/11/2003 08:30	155
03/04/2003 10:00	98.8
04/03/2003 10:00	74.8
05/05/2003 10:00	58.5
06/19/2003 10:00	96.3

WWWA WPCP
VA0025020

August 2008		EFFLUENT (OUTFALL 001)				STREAM		
Day	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)	D.O. MIN (mg/L) (4.0*)	D.O. MEAN (mg/L) (5.0)**	FLOW (MGD)
7	0.07	26.93	<5.0	21	7.0	9.01		23
8		28.15	<5.0	21	7.3	6.85		23
9		27.56	<5.0	21	7.2	6.7		19
10		27.05	<5.0	21	7.3	6.25		19
11		26.21	<5.0	18	7.4	**2.14**	6.9	19
12		25.55	<5.0	18	7.5	**3.56**	7.41	16
13		27.49	<5.0	18	7.3	4.2		17
14		26.35	<5.0	19	7.4	**2.16**	4.98	17
15	Trace	27.36	<5.0	20	7.7	**3.26**	5.83	17
16	0.02	27.21	<5.0	19	7.3	5.07		22
17	Trace	37.08	<5.0	20	7.3	**3.22**	**4.97**	19
18		27.44	<5.0	19	7.3	**3.82**	**4.44**	17
19		27.60	<5.0	20	7.0	**2.4**	**3.49**	15
20		27.72	<5.0	20	7.1	**2.27**	**2.91**	14
21	Trace	27.77	<5.0	21	7.0	**1.69*** **	6.72	15
22		27.69	<5.0	18	7.2	5.66	10.25	16
23		26.78	<5.0	19	7.2	5.81	9.54	16
24		29.01	<5.0	19	7.2	**3.86**	8.45	16
25		43.39	<5.0	19	7.3	**1.76**	7.92	16
26	0.04	29.90	12.0	22	7.5	**2.64**	7.08	16
27	3.50	29.83	<5.0	19	7.2	7.45		618
28	1.02	28.34	<5.0	19	7.4	8.65		191
29		28.22	<5.0	19	7.3	7.53		79
30		27.42	<5.0	20	7.5	6.78		74
31		26.34	<5.0	20	7.6	6.43		58
total	4.65	714	12					
mean		29	12	20	7.3	4.9		

* 4.0 mg/L minimum DO criteria
**5.0 mg/L daily average DO criteria
8/19/08 membrane installed
***8/21/08 at 10:30 4.82 mg/L 11:30 12.81 mg/L

WVWA WPCP
VA0025020

Sept. 2008		EFFLUENT (OUTFALL 001)			
DAY	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)
1		30.89	0.0	19	7.1
2		30.12	0.0	19	7.5
3		29.71	0.0	17	7.3
4		28.70	0.0	19	7.3
5		28.05	0.0	19	7.0
6	0.80	39.37	0.0	18	6.9
7		29.57	0.0	20	7.6
8		29.19	0.0	19	7.4
9	0.07	28.62	0.0	20	7.4
10	0.09	28.99	0.0	19	7.4
11	0.03	29.24	0.0	19	7.5
12	Trace	27.77	0.0	19	7.0
13	0.04	27.71	0.0	20	7.1
14		27.47	0.0	21	7.1
15		27.94	0.0	21	7.2
16	Trace	28.04	0.0	19	7.5
17		27.67	0.0	19	7.1
18		27.45	0.0	18	7.4
19		25.18	0.0	18	7.6
20		26.88	0.0	17	7.9
21		25.92	0.0	16	7.7
22		27.92	0.0	16	7.7
23		25.76	0.0	16	7.6
24		27.02	0.0	15	7.8
25		27.10	0.0	16	7.9
26	0.33	33.60	0.0	17	7.6
27	0.81	45.58	0.0	19	7.4
28	0.03	32.98	0.0	19	7.6
29		31.32	0.0	19	7.5
30	Trace	31.52	0.0	19	8.3
total	2.20		0.0		
mean		29.58	0.0	18	7.4

9/5/08 membrane installed.
9/26/08 membrane installed.

WWWA WPCP
VA0025020

Oct. 2008		EFFLUENT (OUTFALL 001)			
DAY	PRECIP (in.)	FLOW (MGD)	BOD_5 (mg/L)	TEMP °C	D.O. (mg/L)
1		29.30	0.0	16	7.6
2		28.68	0.0	18	7.3
3		28.09	0.0	14	8.2
4		26.57	0.0	14	7.3
5		27.25	0.0	15	7.7
6		27.52	0.0	16	8.1
7		26.93	0.0	17	7.5
8	0.04	28.15	0.0	17	7.7
9	0.11	27.56	0.0	17	7.7
10		27.05	0.0	18	7.7
11		26.21	0.0	17	8.3
12		25.55	0.0	16	8.1
13		27.49	0.0	15	8.0
14		26.35	0.0	15	8.0
15		27.36	0.0	16	8.1
16	trace	27.21	0.0	16	7.9
total	0.15	437.27	0.0		
mean		27.33	0.0	16	7.8

Deployment 1: 6/19/02 15:15 - 7/10/02 16:45

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
7/9/2002	4.39	6.7
7/10/2002*	**2.88**	**4.8**

* Flow dropped to between to 30-31 cfs which was below 7Q10 of 37.3 cfs noted in permit file.

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
6/20/2002	15:20	7.73	8.90
7/3/2002	16:40	7.36	7.00
7/10/2002	17:00	4.38	4.88

Deployment 2: 7/12/02 10:15 - 8/01/02 9:45

Low Daily Minimum DO Measurements

None

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
7/12/2002	15:20	6.95	5.20
7/19/2002	16:15	6.54	6.30
7/25/2002	16:05	6.42	5.16
8/1/2002	10:05	6.23	**3.40**

Deployment 3: 8/2/02 9:00 - 8/22/02 8:45

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
8/16/2002	4.46	5.0
8/17/2002	4.75	5.3

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
8/2/2002	9:00	6.16	**3.82**
8/9/2002	9:40	6.57	8.60
8/15/2002	9:00	6.34	8.70
8/22/2002	9:45	5.95	7.70

Deployment 4: 8/23/02 9:00 - 9/12/02 12:30

Low Daily Minimum DO Measurements

8/23/02 9:00 to 9/3/02 0:00

Date	Minimum DO mg/l	Mean DO (mg/l)
8/27/2002	4.73	5.6
8/31/2002	4.79	5.6

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
8/23/2002	9:00	6.60	6.90
8/29/2002	10:00	6.23	10.30

9/3/02 00:15 to 9/12/02 12:30

Date	Minimum DO mg/l
9/3/2002*	**3.26**
9/4/2002*	**2.21**
9/5/2002*	**1.61**
9/6/2002*	**1.75**
9/7/2002*	**1.06**
9/8/2002*	**0.91**
9/9/2002*	**1.31**
9/10/2002*	**1.07**
9/11/2002*	**1.16**
9/12/2002*	**1.34**

*malfunctioning batteries changed 9/12/02

QC data measurements and lack of low DO evidence in river supports conclusion that low DO readings may have been due to malfunctioning batteries.

QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
9/5/2002	13:30	**1.61**	10.00
9/12/2002	11:15	**1.82**	7.60
9/20/2002	9:30	7.33	9.30

Deployment 5: 9/12/02 15:15 - 9/23/02 17:00

Low Daily Minimum DO Measurements

Date	Minimum DO mg/l	Mean DO (mg/l)
9/19/2002	4.53	7.2
9/22/2002	4.98	7.1
9/23/2002	**3.89**	

9/23/02 after 11 days Sonde ceased operation

QA/QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
10/1/2002	16:25	*	9.40
10/4/2002	11:00	*	7.60

*No Reading due to battery failure

Deployment 6: 10/07/02 16:00 - 10/14/02 09:15

Low Daily Minimum DO Measurements

None

QA/QC data

Date	Time	Sonde DO mg/l	QC DO mg/l
10/7/2002	16:00	9.26	9.30
10/14/2002	9:45	7.73	7.90

DO measurement below water quality criteria are bolded.

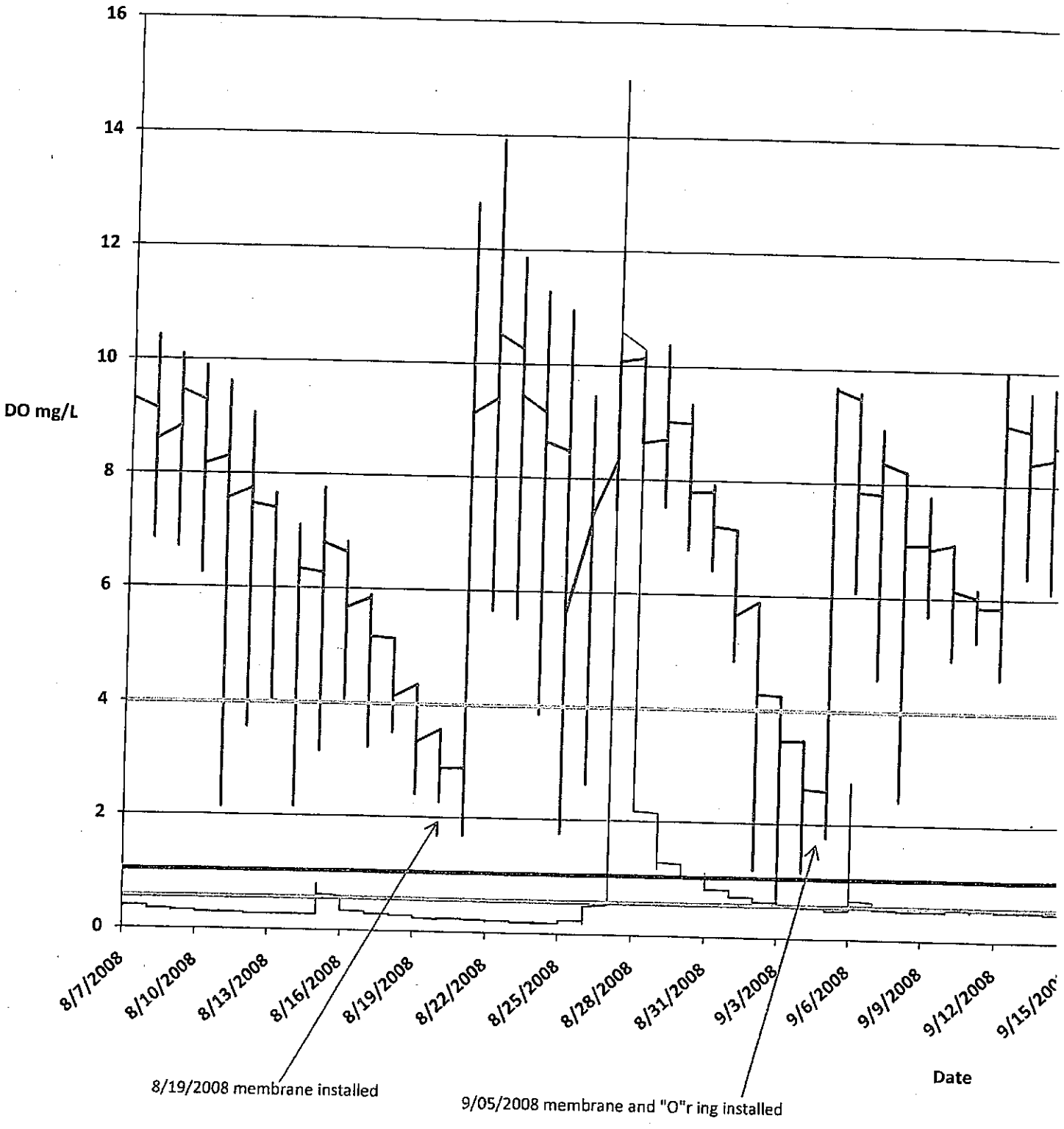
Deployment 7: 6/18/08 14:55 - 6/19/08 11:40

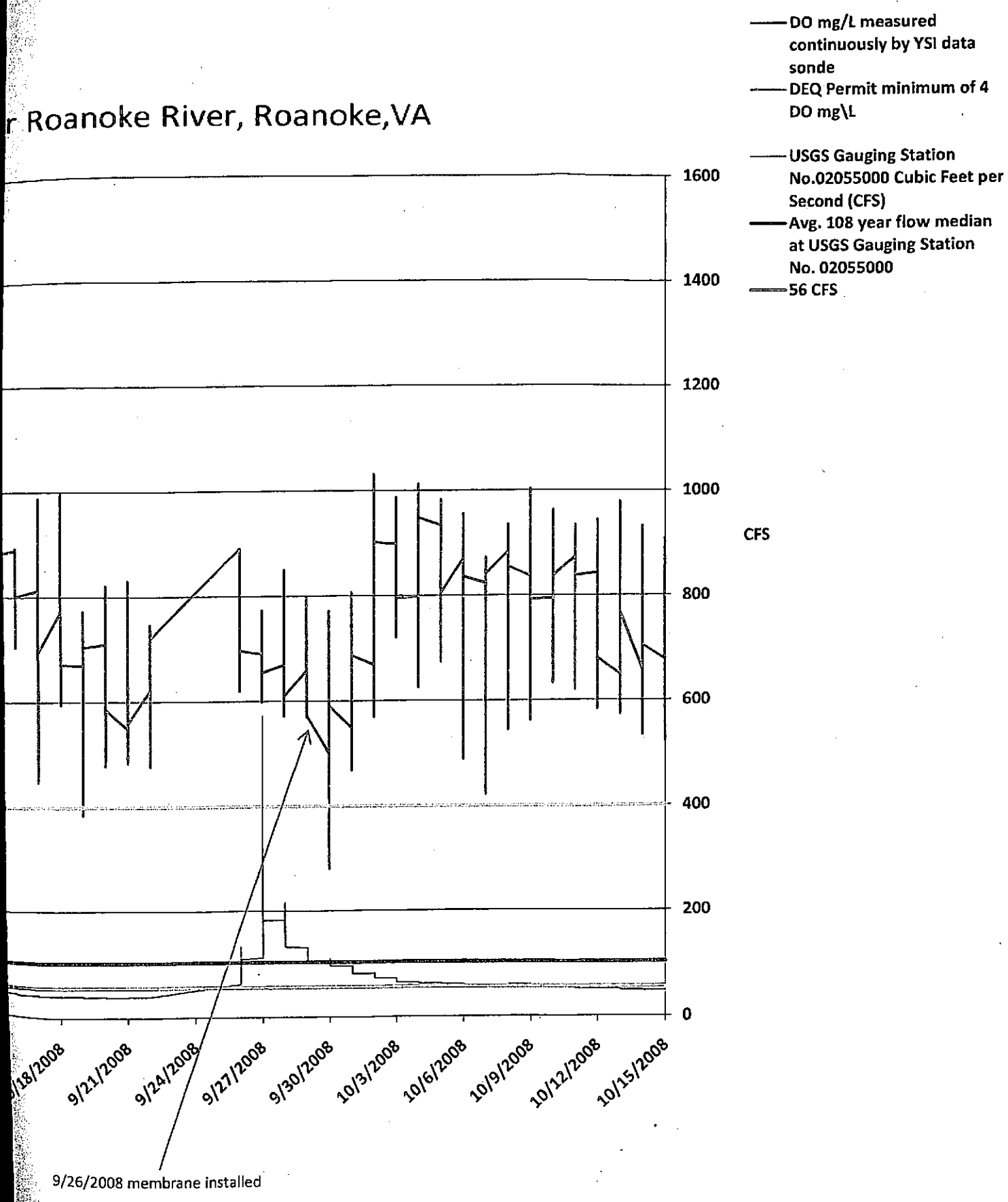
Low Daily Minimum DO Measurements

Date	Minimum DO mg/l
6/18/2008	8.73
6/19/2008	7.46

HSMM

Dissolved Oxygen 2008 Annual Study




r Roanoke River, Roanoke,VA
DO mg/L measured continuously by YSI data sonde
DEQ Permit minimum of 4 DO mg\L
USGS Gauging Station No.02055000 Cubic Feet per Second (CFS)
Avg. 108 year flow median at USGS Gauging Station No. 02055000
56 CFS
1600
1400
1200
1000
800
600
400
200
0
CFS
9/18/2008
9/21/2008
9/24/2008
9/27/2008
9/30/2008
10/3/2008
10/6/2008
10/9/2008
10/12/2008
10/15/2008
9/26/2008 membrane installed

Attachment F

Ambient Water Quality Planning Evaluations

- **2012 Impaired Waters Report (Excerpt)**
- **Water Quality Management Planning Regulation -- Roanoke River Basin (9 VAC 25-720-80) (Excerpt)**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Cause Group Code: **L04R-01-BEN** **Roanoke River**

Location: Roanoke River mainstem from the City of Salem downtown intake downstream to the backwaters of the Niagara impoundment.
Note: Impounded waters of Niagara Dam are not included with this impairment.

City / County: Roanoke City Roanoke Co. Salem City

Use(s): Aquatic Life

Cause(s) / VA Category: Benthic-Macroinvertebrate Bioassessments/ 4A

The Roanoke River General Standard - Benthic (Sediment) Total Maximum Daily Load (TMDL) is U.S. EPA approved 5/10/2006 [Fed. ID 33861] and SWCB approved 9/07/2006. Formerly coded VAW-L04R-01.

The benthic impairment is extended upstream 3.87 miles with the 2010 Integrated Report (IR) from the mouth of Mason Creek upstream to the City of Salem downtown intake on the Roanoke River. This portion is nested within the approved General Standard - Benthic (Sediment) TMDL Watershed.

The benthic impairment is extended downstream with the 2008 Integrated Report (IR) for 3.14 miles from Niagara Dam downstream to the mouth of Back Creek (station 4AROA198.08). This portion of the impairment is Category 5A as the TMDL Study did not address these waters. A new Cause Group Code of L04R-03-BEN and Fact Sheet are assigned to this portion with the 2012 IR as a result. Category 4A waters equal 11.31 miles. The impairment does not include the impounded waters of Niagara Dam.

4AROA212.17- (Rt. 11 Bridge - below Eaton, Inc.) Bio 'IM' Four VSCI surveys with average score of 59.5 (2005-2006 & 2009-2010) within the 2012 data window. There are five VSCI surveys (2001-2006) conducted at this site in 2008 with average seasonal scores of spring 59.6 and fall 57.1. The average score is 58.1. The 2010 average score is 56.85 from four surveys (2003-2006) as there are no additional data within the 2010 data window. There are fewer taxa and fewer sensitive taxa compared to the reference site. The modified family biotic index consistently shows a slight-to-moderate impact from organic pollution. The benthic community appears to be more sensitive to drought conditions.

4AROA206.27- (Wasena Park) Bio 'IM' The 2012 assessment reports four VSCI surveys (spring 2005, fall 2006, fall 2009 & 2010) with an average score of 62.06. The 2010 IR reports three VSCI surveys (2003-2006) score with an average of 57.92. 2008 assessment reports four VSCI surveys (2001-2006) with an average score of 57.4. Non-impaired samples show an increase in diversity and a decrease in pollution tolerant midge larvae; family Chironomidae. Impaired samples show a decrease in diversity and an increase in pollution tolerant midge larvae; family Chironomidae. A sewer line that impounded the river above this station was removed. The removal indirectly restored a riffle and may have restored the habitat.

4AROA202.20- (13th Street Bridge - above STP) Bio 'J' 2012 data find from three VSCI surveys (2005 & 2009-2010) an average score of 54.28. The final 6-year average (n=3) VSCI score is driven by a fall 2005 score of 34.69. For seven seasons samples were not collected at this station. The eighth and ninth seasons following the 34.69 score the VSCI scores were non-impaired. More data need to be collected to determine if the 2005 impaired VSCI score is an indicator of typical water quality or an indicator of the abnormal runoff and flows during the active hurricane season of 2004. There are no additional data from the 2010 data window where Bio 'IM' four VSCI surveys (2003-2005) record impairment with an average VSCI score of 49.9. 2008 assessment reports five VSCI surveys (2001-2005) with an average score of 51.4 also finding impairment. Historically sedimentation has decreased the amount of substrate available for macro invertebrate colonization. The benthic community declined from fall 2001 to fall 2003 and improved during spring and fall 2004. The fall 2004 survey resulted in a non-impaired score of 65.08. This is the highest VSCI score found at this station. This was the only Roanoke River station sampled in fall 2004 and it was used as the benthic macro invertebrate sample location for a nearby Probabilistic monitoring site (4AROA202.32). The lower limit for a reference site is 60.0.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Assessment Unit / Water Name / Description	Cause Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	0.86
VAW-L04R_ROA04A00 / Roanoke River / Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	0.25
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	0.35
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	4A Benthic-Macroinvertebrate Bioassessments		1996	5/10/2006	2.21

Roanoke River

DCR Watershed: L04*

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Aquatic Life			
Benthic-Macroinvertebrate Bioassessments - Total Impaired Size by Water Type:			**11.31**

Sources:

Discharges from Municipal Separate Storm Sewer Systems (MS4)	Drought-related Impacts	Industrial Point Source Discharge	Industrial/Commercial Site Stormwater Discharge (Permitted)
Municipal (Urbanized High Density Area)	Municipal Point Source Discharges	Post-development Erosion and Sedimentation	Residential Districts
Sediment Resuspension (Clean Sediment)	Sediment Resuspension (Contaminated Sediment)	Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO)	

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Cause Group Code: **L04R-01-BAC** **Roanoke River and Smith Mountain Lake**

Location: The upstream limit is at the Roanoke County Spring Hollow Reservoir water intake downstream to the mouth of Falling Creek in Smith Mountain Lake.

City / County: Bedford Co. Franklin Co. Roanoke City Roanoke Co. Salem City

Use(s): Recreation

Cause(s) / VA Category: Escherichia coli/ 4A

The Roanoke River Bacteria Total Maximum Daily Load (TMDL) is U.S. EPA approved on 8/02/2006 [Fed ID 24538] with SWCB approval on 9/07/2006. 1996 & 2002 fecal coliform (FC) observations are the basis for the original bacteria impaired listing. The 2010 total bacteria impaired length is 29.51 miles and 350.06 acres in Smith Mountain Lake. Geometric mean calculations from previous assessments are not valid in 2010 in light of the four sample per month requirement of the new WQS criterion.

Station 4AROA227.42 (Rt. 773 Bridge in Lafayette) is included in the 1999 Federal Consent Decree as an Attachment B station for fecal coliform bacteria. The station was not listed in 2002 as exceedances of the former WQS 1000 cfu/100 ml instantaneous criterion were at 5 percent. The waters were not de-listed in recognition of the forth coming change of the fecal coliform WQS instantaneous criterion from 1000 to 400 cfu/100 ml. The 2004 Integrated Report (IR) records an 11.8 percent exceedance rate and initial 303(d) Listing for fecal coliform bacteria. In 2008 Escherichia coli (E.coli) replaces fecal coliform bacteria as the indicator as per Water Quality Standards [9 VAC 25-260-170. Bacteria; other waters]. The 2008 assessment reports one of 21 Escherichia coli (E.coli) samples in excess of the 235 cfu/100 ml instantaneous criterion and was partially delisted with the 2008 IR for 2.22 miles. 2010 and 2012 assessments find continued Full Support from 4AROA227.42.

4AROA224.54- (Rt. 639 Bridge at Riverside) There are no additional E.coli data beyond the 2008 Integrated Report (IR) where E.coli exceeds the criterion in two of 11 observations. Maximum excursions are 400 cfu/100 ml and 780. The results are the same for both the 2008 and 2010 assessments. The 2006 IR finds E.coli exceeds the instantaneous criterion in two of eight observations. The maximum exceedance is 780 cfu/100 ml.

4AROA220.94- (Rt. 639 Bridge just south of Wabun) 2012, 2010 and 2008 results are the same with no additional data. E.coli samples exceed the instantaneous criterion in two of 12 observations ranging from 250 to 850 cfu/100 ml. In 2006 E.coli exceeds the criterion in two of eight observations. The maximum exceedance is 780 cfu/100 ml.

4AROA215.13 - No additional E.coli data beyond the 2008 IR. One of 12 Escherichia coli (E.coli) observations exceeds the 235 cfu/100 ml instantaneous criterion at 920 cfu/100 ml.

4AROA212.17- (Rt. 11 Bridge - below Eaton, Inc.) There are no additional E.coli data beyond the 2010 IR where four of 23 E.coli samples exceed the instantaneous criterion in 2010. Exceedances range from 290 cfu/100 ml to 790. Four of 23 E.coli samples also exceed the 235 cfu/100 ml WQS instantaneous criterion within 2008 data window. E.coli excursions are the same as 2010.

4AROA205.73- (Franklin Road Bridge, Roanoke, VA) There are no additional data within the 2010 data window. The 2008 assessment reports eight of 32 E.coli samples exceed the instantaneous criterion and three of five geometric mean calculations exceed the former (two samples/calendar month) WQS 126 cfu/100 ml criterion. The 2008 range of exceedance is from 270 to 570 cfu/100 ml. 2006 results find seven of 20 E.coli samples exceed the instantaneous criterion with the same range of exceedance. E.coli geomeans exceed the former WQS (2 samples/month) 126 cfu/100 ml criterion in three of six calculations.

4AROA202.20- (13th Street Bridge - above STP) The 2012 assessment finds E.coli exceeds the instantaneous criterion in 4 of 36 obs. Exceedance range: 280 to 1400 cfu/100 ml. 2010 data reveal nine of 45 E.coli samples in excess of the instantaneous criterion. Values in excess range from 280 to greater than 2000 cfu/100 ml. No geometric means are

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

calculated due to insufficient data. Eight of 33 E.coli samples exceed the instantaneous criterion in 2008 and two of six geometric mean calculations exceed the former WQS (2 samples/month) 126 cfu/100 ml criterion. The 2008 range of exceedance is the same as 2010. 2006 E.coli exceeds the instantaneous criterion of in six of 21 observations. Exceedance range: 330 to greater than 2000 cfu/100 ml. Two of six geometric mean calculations exceed the former WQS criterion as in 2008.

4AROA199.20- (Blue Ridge Parkway Bridge - Niagara) The 2012 assessment finds Escherichia coli (E.coli) exceed in 5 of 20 obs. Exceedance range is 250 to greater than 2000 cfu/100 ml. Both the 2010 and 2008 assessments find nine of 21 E.coli samples exceed the instantaneous criterion of 235 cfu/100 ml. Exceedances range from 280 cfu/100 ml to greater than 2000. 2006 results found six of 12 samples exceeding while the range is from 280 to 610 cfu/100 ml.

4AROA196.05- (McVeigh Ford) E.coli bacteria exceed the 235 cfu/100 ml instantaneous criterion in 9 of 41 observations within the 2012 data window. Exceedances range from 250 to 1000 cfu/100 ml within the 2012 data window. E.coli data within the 2010 data window find 10 of 38 samples exceeding the instantaneous criterion. Values in excess of the criterion range from 250 to greater than 2000 cfu/100 ml. E.coli samples for 2008 find 10 of 32 in excess of the instantaneous criterion ranging from 250 to greater than 2000 cfu/100 ml. 2006 samples find five of 18 E.coli samples exceed the instantaneous criterion ranging from 400 to greater than 2000 cfu/100 ml.

4AROA192.94- (Hardy Ford) E.coli samples exceed the 235 cfu/100 ml instantaneous criterion in two of 42 samples within the 2012 data window. Exceedances are 350 and 1600 cfu/100 ml. 2010 data reveal a range of E.coli samples in excess of the instantaneous criterion from 280 to greater than 2000 cfu/10 ml in eight of 51 observations. 2008 E.coli samples exceed the 235 cfu/100 ml instantaneous criterion in eight of 44 observations with the excursion range the same as 2010. The 2006 IR finds seven of 30 samples in excess of the instantaneous criterion and the same range of exceedance also.

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA01A00 / Roanoke River / Roanoke River mainstem waters from Niagara Dam downstream to the mouth of Back Creek (PWS section 6i).	4A	Escherichia coli		2006	8/2/2006	3.14
VAW-L04R_ROA02A00 / Roanoke River Niagara / These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	4A	Escherichia coli		2006	8/2/2006	0.78
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A	Escherichia coli		2006	8/2/2006	0.86
VAW-L04R_ROA04A00 / Roanoke River / Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	4A	Escherichia coli		2006	8/2/2006	0.25
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	4A	Escherichia coli		2006	8/2/2006	0.35

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Assessment Unit / Water Name / Description	Cause Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	4A Escherichia coli		2006	8/2/2006	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	4A Escherichia coli		2006	8/2/2006	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	4A Escherichia coli		2006	8/2/2006	2.21

Roanoke River and Smith Mountain Lake

DCR Watershed: L04*

Recreation

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Escherichia coli - Total Impaired Size by Water Type:			**15.23**

Sources:

- Discharges from Municipal Separate Storm Sewer Systems (MS4)
- Livestock (Grazing or Feeding Operations)
- Municipal (Urbanized High Density Area)
- On-site Treatment Systems (Septic Systems and Similar Decentralized Systems)
- Sanitary Sewer Overflows (Collection System Failures)
- Unspecified Domestic Waste
- Wet Weather Discharges (Non-Point Source)
- Wildlife Other than Waterfowl

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Cause Group Code: **L04R-01-HG** **Roanoke River**

Location: Roanoke River from the confluence of Mason Creek downstream to the confluence of Tinker Creek.

City / County: Roanoke City Roanoke Co. Salem City

Use(s): Fish Consumption

Cause(s) / VA Category: Mercury in Fish Tissue/ 5A

This initial 2010 303(d) Listing is based on 2006 fish tissue collections and new Water Quality Standards effective 2/01/2010. Mercury (Hg) exceedances of the DEQ 0.3 parts per million (ppm) and Virginia Department of Health (VDH) level of concern of 0.5 ppm are found in fish tissue causing impairment of the Fish Consumption Use. No VDH Fish Consumption or Drinking Water Advisories are issued for mercury for these waters. Please visit http://www.deq.virginia.gov/info/mercury.html for more information about mercury contamination and http://www.vdh.virginia.gov/Epidemiology/dee/PublicHealthToxicology/Advisories/ for VDH Advisories or Bans.

4AROA206.80 (Roanoke R. @Wasena Park near Rt. 11 Bridge)- Exceedance of the Mercury (Hg) WQS based tissue value (TV) of 0.3 ppm is found in two species from 2006 collections; smallmouth bass (1 fish 37.0 cm) at 0.37 and (4 fish composite 21.8-27.5 cm) at 0.537 ppm and rock bass (6 fish composite 17.4-19.4 cm) at 0.446 ppm. There are no additional data.

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	5A	Mercury in Fish Tissue		2010	2022	0.35
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	5A	Mercury in Fish Tissue		2010	2022	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	5A	Mercury in Fish Tissue		2010	2022	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	5A	Mercury in Fish Tissue		2010	2022	2.21

Roanoke River

DCR Watershed: L04*

Fish Consumption

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Mercury in Fish Tissue - Total Impaired Size by Water Type:			**10.20**

Sources:

Source Unknown

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Cause Group Code: **L12L-01-PCB** **Roanoke River, Tinker Creek and Peters Creek.**

Location: Roanoke River from the confluence of the North and South Forks downstream to Niagara Dam. The impairment includes Peters Creek from the Rt. 460 Bridge downstream to its confluence on the Roanoke River; and Tinker Creek from the mouth of Deer Branch downstream to the Tinker Creek confluence on the Roanoke River.

City / County: Botetourt Co. Montgomery Co. Roanoke City Roanoke Co. Salem City

Use(s): Fish Consumption Public Water Supply Wildlife

Cause(s) / VA Category: PCB in Fish Tissue/ 4A PCB in Water Column/ 4A

The waters of the Roanoke River (28.60 miles), Peters Creek (2.52 miles) and Tinker Creek (5.33 miles) are under a Virginia Department of Health (VDH) Fish Consumption Advisory for Polychlorinated Biphenols (PCB) issued 7/27/05. An additional 3.14 miles on the Roanoke from Niagara Dam to Smith Mtn. Lake are under advisory and described in Fact Sheet L12L-02-PCB. The VDH Advisory is based on fish tissue found to originally contain greater than 50 parts per billion (ppb) of PCBs. The DEQ Water Quality Standard (WQS) based tissue value (TV) criterion is 20 ppb in fish tissue. The previous advisory (issued 10/20/03) recommended that no more than two eight-ounce meals per month of flathead catfish (less than 32 inches in size), striped bass, gizzard shad, redhorse sucker, largemouth bass and carp should be consumed. Per the previous advisory, flathead catfish (greater than 32 inches in size) should not be eaten. The advisory has been updated to also recommend that no more than two eight-ounce meals per month of channel catfish should be consumed.

The Roanoke (Staunton) River PCB TMDL Study is U.S. Environmental Protection Agency (EPA) approved on 4/9/2010 and State Water Control Board (SWCB) approved 12/9/2010. A 3.14 mile portion of the Roanoke River is not included in the PCB TMDL Study. The following Federal Identification Numbers by watershed are approved:

L03R Roanoke River: 38624, 38625, 38627, 38629, 38543, 38630
L04R Roanoke River: 24537, 38552, 38632, 38633, 38634, 38635, 38636
Peters Creek: 38468
L05R Tinker Creek: 38467

Fish tissue collections from locations on the Roanoke mainstem, Blackwater River, Mason Creek, Mudlick Creek, Paint Bank Branch, Peters Creek, Tinker Creek and the North and South Forks of the Roanoke River are reviewed by the VDH in making an advisory determination. A complete listing of collection sites and associated fish tissue data are available at http://www.deq.virginia.gov/fishtissue/fishtissue.html. A more detailed presentation of the data can also be found using an interactive mapping application at http://www.deq.virginia.gov/wqa/. The VDH Advisory information is also available via the web at http://www.vdh.virginia.gov/epidemiology/DEE/PublicHealthToxicology/Advisories/index.htm.

Thirty day deployment of Semi-Permeable Membrane Devices (SPMD) or virtual fish in 2008 find exceedances of the WQS PCB water column criterion of 0.00064 micrograms per liter (µg/L) or 640 picograms per liter (pg/L). Exceedances are recorded for the Fish Consumption Use via WQS 'Other Waters' (12.09 miles) as well as the Wildlife Use (12.09 miles) and the 'Public Water Supply Use' (PWS 1.64 miles) for the human health criterion at the stations listed below. The 640 pg/L criterion applies to these Uses. The 'PCB in Water Column' impairment on the mainstem of the Roanoke River extends from the confluence of Mason Creek downstream to the mouth of Back Creek (15.23 miles). Fact Sheet L12L-02-PCB describes and the additional 3.14 miles for each of these uses. The 'PCB in Water Column' impairment overlays a total 15.23 mile portion of the overall VDH Fish Consumption Advisory area above Smith Mountain Lake.

4AROA207.08- (Near Memorial Bridge downstream of Peters Creek)- 2008 SPMD 'OE'. Exceeds PCB WQS 'Other Waters' 640 pg/L criterion from one of two deployments at 642.

4AROA204.76 (Downstream of Ore Br., near VA Scrap Iron Co. above American Visco)- Two 2008 SPMD deployments find exceedance of the WQS 'Other Waters' 640 pg/L criterion at 987 and 3,014 pg/L.

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

4AROA202.20 (13th Street Bridge - above STP)- Two 2008 SPMD deployments find exceedance of the WQS 'Other Waters' 640 pg/L criterion at 1,376 and 3,044 pg/L.

4AROA199.20 (Blue Ridge Parkway Bridge - Niagara)- Two 2008 SPMD deployments find exceedance of the WQS 'Other Waters' and 'PWS' 640 pg/L criterion at 1,213 and 1,588 pg/L.

Assessment Unit / Water Name / Description	Cause Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_PEE01A02 / Peters Creek / Peters Creek mainstem from its confluence with the Roanoke River upstream to the Melrose Avenue Bridge (Rt. 11/460).	4A PCB in Fish Tissue		2004	4/9/2010	2.52
VAW-L04R_ROA02A00 / Roanoke River Niagara / These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	4A PCB in Fish Tissue		2002	4/9/2010	0.78
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A PCB in Fish Tissue		2002	4/9/2010	0.86
VAW-L04R_ROA04A00 / Roanoke River / Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	4A PCB in Fish Tissue		2002	4/9/2010	0.25
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	4A PCB in Fish Tissue		2002	4/9/2010	0.35
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	4A PCB in Fish Tissue		2002	4/9/2010	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	4A PCB in Fish Tissue		2002	4/9/2010	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	4A PCB in Fish Tissue		2002	4/9/2010	2.21

Roanoke River, Tinker Creek and Peters Creek.

DCR Watershed: L04*	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Fish Consumption			
PCB in Fish Tissue - Total Impaired Size by Water Type:			**14.61**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA02A00 / Roanoke River Niagara / These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	4A	PCB in Water Column		2010	4/9/2010	0.78
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A	PCB in Water Column		2010	4/9/2010	0.86
VAW-L04R_ROA04A00 / Roanoke River / Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	4A	PCB in Water Column		2010	4/9/2010	0.25
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	4A	PCB in Water Column		2010	4/9/2010	0.35
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	4A	PCB in Water Column		2010	4/9/2010	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	4A	PCB in Water Column		2010	4/9/2010	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	4A	PCB in Water Column		2010	4/9/2010	2.21

Roanoke River, Tinker Creek and Peters Creek.

DCR Watershed: L04*

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Fish Consumption			
PCB in Water Column - Total Impaired Size by Water Type:			**12.09**

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA02A00 / Roanoke River Niagara / These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	4A	PCB in Water Column		2010	4/9/2010	0.78

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Assessment Unit / Water Name / Description	Cause Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A PCB in Water Column		2010	4/9/2010	0.86

Roanoke River, Tinker Creek and Peters Creek.

DCR Watershed: L04*

Public Water Supply

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
PCB in Water Column - Total Impaired Size by Water Type:			**1.64**

Assessment Unit / Water Name / Description	Cause Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L04R_ROA02A00 / Roanoke River Niagara / These are the Roanoke River mainstem impounded waters of the Niagara Dam (PWS section 6i).	4A PCB in Water Column		2010	4/9/2010	0.78
VAW-L04R_ROA03A00 / Roanoke River Niagara / Roanoke River mainstem from near the backwaters of the Niagara Impoundment upstream to the end of the WQS designated public water supply (PWS section 6i) segment. The upstream ending of the PWS segment from SML 795 ft. pool elevation.	4A PCB in Water Column		2010	4/9/2010	0.86
VAW-L04R_ROA04A00 / Roanoke River / Roanoke R. mainstem from near the backwaters of Niagara Impoundment upstream to the Tinker Creek confluence on the Roanoke River (section 6). The upstream ending of the WQS designated public water supply (PWS) segment from SML 795 ft. pool elevation.	4A PCB in Water Column		2010	4/9/2010	0.25
VAW-L04R_ROA05A00 / Roanoke River / Roanoke River mainstem from the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant downstream to the Tinker Creek confluence (WQS section 6).	4A PCB in Water Column		2010	4/9/2010	0.35
VAW-L04R_ROA06A00 / Roanoke River / Roanoke River mainstem from the Murray Run mouth downstream to the Western Virginia Water Authority Roanoke Regional Water Pollution Control Plant.	4A PCB in Water Column		2010	4/9/2010	4.33
VAW-L04R_ROA07A00 / Roanoke River / Roanoke River mainstem from the Peters Creek mouth downstream to the Murray Run confluence on the Roanoke River.	4A PCB in Water Column		2010	4/9/2010	3.31
VAW-L04R_ROA08A02 / Roanoke River / Roanoke River mainstem from the Mason Creek mouth downstream to the confluence of Peters Creek on the Roanoke River.	4A PCB in Water Column		2010	4/9/2010	2.21

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L04*

Roanoke River, Tinker Creek and Peters Creek.

DCR Watershed: L04*	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Wildlife			
PCB in Water Column - Total Impaired Size by Water Type:			**12.09**

Sources:

Landfills	Source Unknown	Urban Runoff/Storm Sewers	Wet Weather Discharges (Non-Point Source)

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

9 VAC 25-720-80. Roanoke River Basin.

EDITOR'S NOTE: 9 VAC 25-720-80 A is not amended; therefore, the text is not set out. 9 VAC 25-720-80 B is stricken in its entirety and is not set out. The new text for 9 VAC 25-720-80 B is set out below.

B. Non-TMDL waste load allocations.

Water Body	Permit No.	Facility Name	Outfall No.	Receiving Stream	River Mile	Parameter Description	WLA	Units WLA
VAW-L04R	VA0072389	Oak Ridge Mobile Home Park	001	Falling Creek UT	0.32	BOD_5	0.85	KG/D
VAW-L04R	VA0025020	Roanoke City Regional Water Pollution Control Plant	001	Roanoke River	201.81	BOD_5	1173	KG/D
						TKN, APR-SEP	318	KG/D
						TKN, OCT-MAR	636	KG/D
			001	Roanoke River	201.81	BOD_5	1173	KG/D
						TKN, APR-SEP	416	KG/D
						TKN, OCT-MAR	832	KG/D
			001	Roanoke River	201.81	BOD_5	1173	KG/D
						TKN, APR-SEP	469	KG/D
						TKN, OCT-MAR	939	KG/D
VAW-L04R	VA0077895	Roanoke Moose Lodge	001	Mason Creek	7.79	BOD_5, JUN-SEP	0.24	KG/D
						TKN, JUN-SEP	0.09	KG/D
VAW-L07R	VA0020842	Bedford County School Board- Stewartsville Elementary School	001	Nat Branch, UT	0.59	BOD_5	0.5	KG/D
VAW-L14R	VA0029254	Ferrum Water and Sewage Auth. - Ferrum Sewage Treatment Plant	001	Storey Creek	9.78	BOD_5	14.2	KG/D
VAW-L14R	VA0085952	Rocky Mount Town Sewage Treatment Plant	001	Pigg River	52	BOD_5	133	KG/D
VAW-L14R	VA0076015	Ronile Incorporated	001	Pigg River	57.24	BOD_5	14.8	KG/D
VAW-L21R	VA0063738	Bedford County School Board - Staunton River High School	001	Shoulder Run, UT	0.95	BOD_5	1.8	KG/D
VAW-L21R	VA0020869	Bedford County School Board - Thaxton Elementary School	001	Wolf Creek, UT	0.35	BOD_5	0.31	KG/D
VAW-L22R	VA0023515	Blue Ridge Regional Jail Auth. - Moneta Adult Detention Facility STP	001	Mattox Creek, UT	3.76	BOD_5	1.66	KG/D
VAW-L25R	VA0020851	Bedford County School Board - Otter River Elementary School	001	Big Otter River, UT	1.15	BOD_5	0.4	KG/D
VAW-L26R	VA0022390	Bedford City - Sewage Treatment Plant	001	Little Otter River	14.36	BOD_5	52.8	KG/D
VAW-L26R	VA0020818	Bedford County School Board - Body Camp Elementary	001	Wells Creek, UT	2.22	BOD_5	0.4	KG/D
VAW-L27R	VA0020826	Bedford County School Board - New London Academy	001	Buffalo Creek, UT	0.67	BOD_5	0.39	KG/D
VAC-L29R	VA0031194	Briarwood Village Mobile Home Park STP	001	Smith Branch, UT	2.82	BOD_5	1.3	KG/D
VAC-L35R	VA0023965	Campbell Co Util & Serv Auth. - Rustburg	001	Mollys Creek	17.81	BOD_5	8.13	KG/D
VAC-L39R	VA0084433	Drakes Branch WWTP	001	Twitty's Creek	6.04	BOD_5	6.4	KG/D
VAC-L39R	VA0024058	Keysville WWTP	001	Ash Camp Creek	7.63	$CBOD_5$, MAY-NOV	32.1	KG/D

Attachment G

Roanoke River TMDLs

- **Bacteria TMDLs for Wilson Creek, Ore Branch, and Roanoke River Watersheds, Virginia, February 2006 (Excerpt)**
- **Benthic TMDL Development for the Roanoke River, March 2006 (Excerpt)**
- **Roanoke River PCB Development, December 2009 (Excerpt)**

Bacteria TMDLs for Wilson Creek, Ore Branch and Roanoke River Watersheds, Virginia

Upper Roanoke River Watershed

Submitted by

Virginia Department of Environmental Quality

Prepared by

GEORGE MASON UNIVERSITY

and

THE Louis Berger Group, INC.
2300 N Street, NW
Washington, DC 20037

February 2006

Executive Summary

This report presents the development of Bacteria TMDLs for the Wilson Creek, Ore Branch and Roanoke River watersheds, located in the Upper Roanoke River Basin. Segments of Wilson Creek, Ore Branch and the Roanoke River were listed as impaired on Virginia's 1998 303(d) Total Maximum Daily Load Priority List and Report (DEQ, 1998) because of violations of the state's water quality standard for fecal coliform bacteria. These segments were also included on Virginia's 2002 303(d) Report on Impaired Waters and 2004 305(b)/303(d) Water Quality Assessment Integrated Report. The impaired segments are located in the Upper Roanoke River Basin in southwestern Virginia.

Description of the Study Area

Wilson Creek is a tributary to the North Fork Roanoke River and is located in Montgomery County, while Ore Branch is a tributary to the Roanoke River and flows from Roanoke County into Roanoke City. The impaired segment of the Roanoke River begins in Salem City and flows through Roanoke City into Roanoke County. All three streams are located in the Upper Roanoke River Basin (USGS Cataloging Unit 03010101). The watershed is approximately 371,658 acres (580 square miles) and drains portions of Floyd, Montgomery, Roanoke, Botetourt, Bedford and Franklin Counties and all of Salem and Roanoke Cities.

Bacteria TMDLs have already been approved for five impaired streams in the watershed: Carvin Creek, Glade Creek, Laymantown Creek, Lick Run and Tinker Creek. The first four impairments all flow into Tinker Creek, which then flows into the Roanoke River just upstream of the Roanoke City/Roanoke County line near Vinton, Virginia. The results of the bacteria TMDLs developed for the Tinker Creek watershed were input into the model developed for this study.

Approximately 40 percent of the drainage basin is located in Roanoke County, 32 percent in Montgomery County and 12 percent in Botetourt County; the remainder of the watershed is divided among Floyd, Franklin and Bedford Counties (six, two and one

percent, respectively) and the Cities of Roanoke and Salem (six and two percent, respectively). The watershed makes up 100 percent of the land area in the Cities of Roanoke and Salem, 90 percent of Roanoke County, 48 percent of Montgomery County, 13 percent of Botetourt County, eight percent of Floyd County and one percent each of Bedford and Franklin Counties. Interstate Route 81 (I-81) and U.S. Route 11 (US-11) run the entire length of the watershed from the northeast near Troutville to the southwest near Christiansburg. U.S. Route 221 (US-221) and the Blue Ridge Parkway pass through the lower section of the watershed in a northeast to southwest direction. U.S. Route 220 (US-220) runs the lower half of the watershed from the north near Trinity to the south near Boones Mill.

Impairment Description

The impaired segment of Wilson Creek (VAW-L02R-02) begins just east of Route 460, off Route 723 near Christiansburg and ends at the mouth of Wilson Creek on the North Fork of the Roanoke River just upstream of Route 603. The segment includes an unnamed tributary 1.65 mi. long that flows into Wilson Creek from the north. Fourteen of 27 samples (52%) collected at the listing station (4AWLN000.40) between January 1, 1998 and December 31, 2002 exceeded the fecal coliform bacteria instantaneous criterion of 400 cfu/100 ml, while two of three samples (67%) collected during the same period exceeded the *Escherichia coli* (*E. coli*) instantaneous criterion of 235 cfu/100 ml.

The entire length of Ore Branch is impaired (VAW-L04R-04), from the headwaters to the mouth of Ore Branch on the Roanoke River. Three of six samples (50%) collected at the listing station (4AORE000.19) between January 1, 1998 and December 31, 2002 exceeded the fecal coliform bacteria instantaneous criterion of 400 cfu/100 ml. In addition to the impaired segments on Wilson Creek and Ore Branch, this report also addresses two impairments on the Roanoke River. The first impaired segment (VAW-L04R-01) begins at the confluence of Mason Creek with the Roanoke River at river mile 210.47 and ends at the outfall of the Roanoke Regional STP at river mile 200.60. This impairment is based on two listing stations: 4AROA212.17 and 4AROA202.20. Eight of 41 samples (20%) collected at 4AROA212.17 and 17 of 58 samples (29%) collected at

4AROA202.20 between January 1, 1998 and December 31, 2002 exceeded the fecal coliform bacteria instantaneous criterion of 400 cfu/100 ml. The second impaired segment (VAW-L04R-02) begins at the Roanoke Regional STP outfall and ends at the Niagara Dam at river mile 198.36. The total length of these four segments is 23.09 miles.

Applicable Water Quality Standards

At the time of the Wilson Creek, Ore Branch and Roanoke River listings, the Virginia Bacteria Water Quality Standard was expressed in fecal coliform bacteria; however, the bacteria water quality standard has been recently changed and is now expressed in E. coli. Virginia's bacteria water quality standard currently states that E. coli bacteria shall not exceed a geometric mean of 126 E. coli counts per 100 ml of water for two or more samples over a 30-day period or an E. coli concentration of 235 counts per 100 ml of water at anytime. However, the loading rates for watershed-based modeling are available only in terms of the previous standard, fecal coliform bacteria. Therefore, the TMDL was expressed in E. coli by converting modeled daily fecal coliform concentrations to daily E. coli concentrations using an in-stream translator. This TMDL was required to meet both the geometric mean and instantaneous E. coli water quality standard.

Watershed Characterization

Land use characterization was based on National Land Cover Data (NLCD) developed by USGS. The watershed is predominantly forested, with some agricultural lands clustered in the northeastern portion of the watershed. Urban and residential areas are clustered around the Cities of Roanoke and Salem in the eastern half of the watershed, with some smaller clusters located on the western edge of the watershed near Christianburg. Forested and agricultural lands consist of 73.2 and 15.4 percent respectively of the total drainage area Urban lands consists of 10 percent of total drainage area.

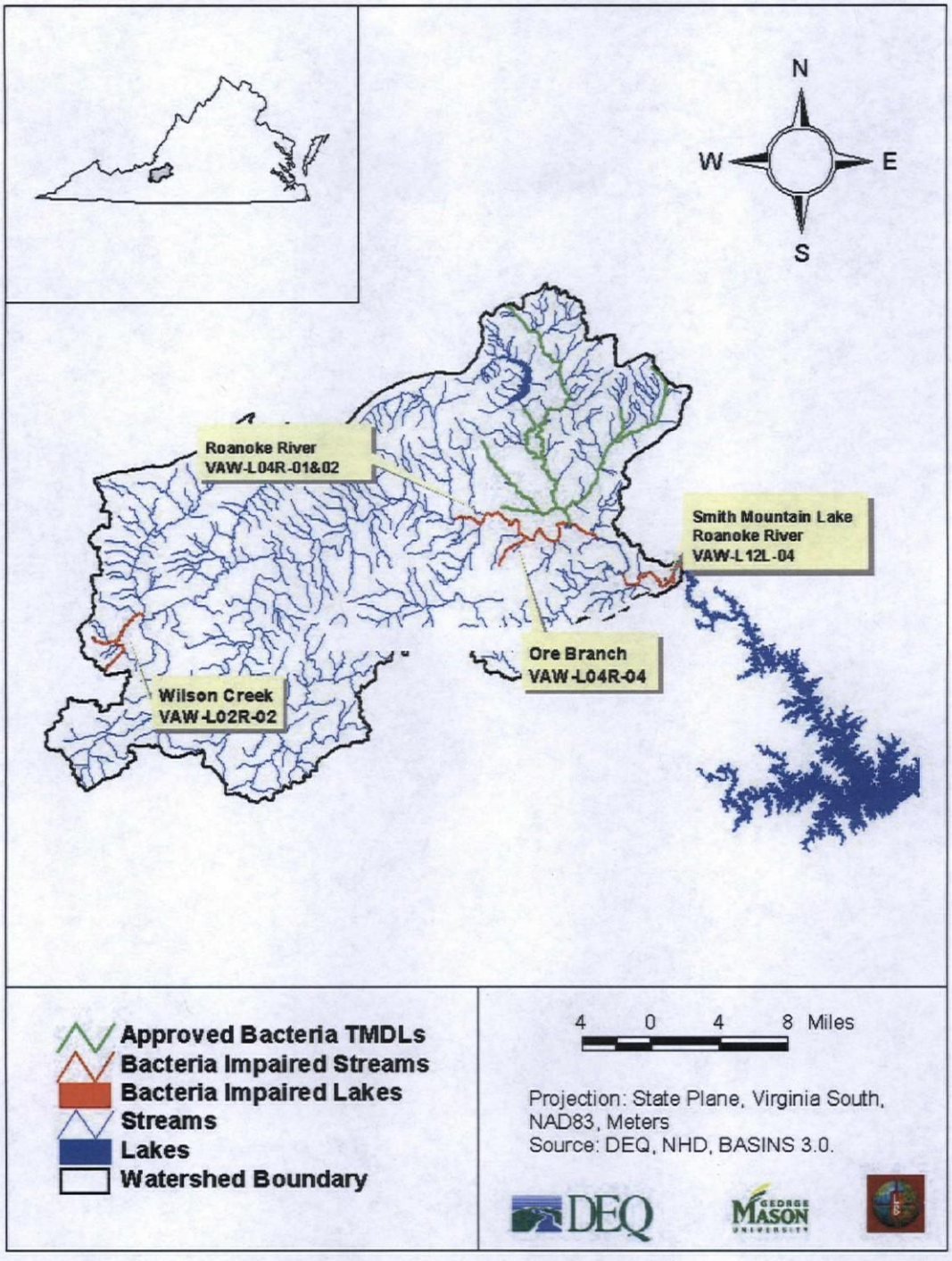
The potential sources of fecal coliform include run-off from livestock grazing, manure applications, industrial processes, residential, and domestic pets waste. Some of these sources are driven by dry weather and others are driven by wet weather. The potential sources of fecal coliform in the watershed were identified and characterized. These

Table E-5: Roanoke River Wasteload Allocation for E. coli

Point Source	Name	Existing Load (cfu/yr)	Allocated Load (cfu/yr)	Percent Reduction
VA0077895	Roanoke Moose Lodge	8.18E+09	8.18E+09	0%
VA0027481	Blacksburg Country Club Sewage Treatment Plant	6.10E+10	6.10E+10	0%
VA0062219	Montgomery County PSA – Elliston-Lafayette WWTP	4.34E+11	4.34E+11	0%
VA0024031	Shawsville Town – Sewage Treatment Plant	3.48E+11	3.48E+11	0%
VA0025020	Western Virginia Water Authority Water Pollution Control Plant	1.08E+14	1.08E+14	0%
VA0028711	Suncrest Heights	3.48E+10	3.48E+10	0%
VAR040022*	Roanoke County	2.37E+13	2.84E+11	98.8%
VAR040004*	City of Roanoke	1.61E+13	1.93E+11	98.8%
VAR040026*	Town of Vinton	2.77E+12	3.32E+10	98.8%
VAR040010*	City of Salem	1.91E+13	2.29E+11	98.8%
VAR040017*	VDOT Roanoke Urban Area	8.94E+11	1.07E+10	98.8%
VAR040030*	Virginia Western Community College	1.44E+11	1.73E+09	98.8%
VAR040050*	Virginia Medical Center	6.56E+11	7.87E+09	98.8%
	Total	**1.72E+14**	**1.10E+14**	**36.0%**

(*) MS4 permit loads based on each share of the MS4 contributing urbanized area of the impairment. Appendix F outlines the steps used in the development of the MS4 E. coli allocations.

Figure 1-2: Wilson Creek, Ore Branch and Roanoke River Listed Segments



5.3.1.3. Roanoke River Waste Load Allocation

There are 6 industrial and municipal permitted facilities in the Roanoke River watershed permitted to discharge bacteria (see Chapter 4). For this TMDL, the wasteload allocation for permitted facilities is to maintain discharge at the design flow limits and bacteria concentrations at their permitted levels of 126 cfu/100mL. Table 5-3 shows the loading from the industrial and municipal permitted facilities in the watershed.

Table 5-3: Roanoke River Wasteload Allocation for E. coli

Point Source	Name	Existing Load (cfu/yr)	Allocated Load (cfu/yr)	Percent Reduction
VA0077895	Roanoke Moose Lodge	8.18E+09	8.18E+09	0%
VA0027481	Blacksburg Country Club Sewage Treatment Plant	6.10E+10	6.10E+10	0%
VA0062219	Montgomery County PSA – Elliston-Lafayette WWTP	4.34E+11	4.34E+11	0%
VA0024031	Shawsville Town – Sewage Treatment Plant	3.48E+11	3.48E+11	0%
VA0025020	Western Virginia Water Authority WPC	1.08E+14	1.08E+14	0%
VA0028711	Suncrest Heights	3.48E+10	3.48E+10	0%
Total		**1.09E+14**	**1.09E+14**	**0%**

Within Wilson Creek there are seven MS4s permits requiring TMDL allocations. Table 5-4 shows the waste load allocations for each MS4. The waste load allocations were based on each municipality's share of the contributing urbanized area of the impairment. Appendix F outlines the steps used in the development of the MS4 E-coli allocations.

Table 5-4: Roanoke River MS4s Wasteload Allocation for E. coli

MS4 Permit Holder	Permit Number	Existing Load (cfu/yr)	Allocated Load (cfu/yr)	Percent Reduction
Roanoke County	VAR040022	2.37E+13	2.84E+11	98.8%
City of Roanoke	VAR040004	1.61E+13	1.93E+11	98.8%
Town of Vinton	VAR040026	2.77E+12	3.32E+10	98.8%
City of Salem	VAR040010	1.91E+13	2.29E+11	98.8%
VDOT Roanoke Urban Area	VAR040017	8.94E+11	1.07E+10	98.8%
Virginia Western Community College	VAR040030	1.44E+11	1.73E+09	98.8%
Virginia Medical Center	VAR040050	6.56E+11	7.87E+09	98.8%
	Total	**6.34E+13**	7.60E+11	**98.8%**

Benthic TMDL Development for the Roanoke River, Virginia

Submitted to

Virginia Department of Environmental Quality

Upper Roanoke River Watershed

Prepared by

THE Louis Berger Group, INC.
2300 N Street, NW
Washington, DC 20037

March 2006

Executive Summary

Introduction

As required by Section 303(d) of the Clean Water Act and current EPA regulations, states are required to develop Total Maximum Daily Loads (TMDLs) for waterbodies that exceed water quality standards. The Roanoke River was included on Virginia's 1996 Section 303(d) TMDL Priority List and Report (DEQ, 1996) because of violations of the General Standard (benthic impairment). The headwaters of the Roanoke River originate in southwest Virginia. The Roanoke River flows through southcentral Virginia before crossing the North Carolina state line and discharging into the Albemarle Sound in North Carolina.

Impairment Listing

The Virginia Department of Environmental Quality (DEQ) uses biological monitoring of benthic macroinvertebrates as one method to assess support of the aquatic life use for a waterbody. Bioassessments of the benthic macroinvertebrate community of the Roanoke River were performed by DEQ using modified Rapid Bioassessment Protocols (EPA, 1999). Results of bioassessments indicated a moderately impaired benthic community at three monitoring stations on the river (4AROA202.20, 4AROA206.03, and 4AROA206.95). Therefore, since the river only partially supports the designated aquatic life use, the General Standard is being violated. As a result, the Roanoke River was included on the Section 303(d) list. Although biological assessments indicated the creek is impaired, additional analyses described in this report were required to identify the causal pollutant (stressor) and sources within the watershed.

The impaired benthic segments (ID #'s VAW-L04R-01 and VAW-L04R-02) are located on the mainstem Roanoke River in the upper section of the Roanoke River basin. Segment VAW-L04R-01 is 9.87 miles in length, beginning at the confluence of Mason Creek and the mainstem Roanoke River, and extending downstream to the Western Virginia Water Authority outfall on the Roanoke River. Approximately 1.46 miles of segment VAW-L04R-02 are listed for benthic impairment, beginning at the Western

Virginia Water Authority outfall on the Roanoke River, and ending at the backwaters of the Niagara Dam impoundment.

Watershed Characterization and Environmental Monitoring

The Roanoke River benthic impairment watershed is approximately 335,785 acres. Forested lands (69.9%), agricultural lands (17.5%), and developed lands (11.1%) represent the dominant land use types in the watershed. The Roanoke River benthic impairment watershed spans the Blue Ridge Mountain ecoregion and the Ridge and Valley ecoregion. The majority of soils in the watershed are comprised of the Berks-Weikert-Laidig, Carbo-Chilhowie-Frederick, Frederick-Carbo-Timberville, Hayesville-Parker-Peaks, and Groseclose-Litz-Shottower soils associations. Combined, these five soil associations account for almost 80 percent of the soils in the watershed.

Environmental monitoring data were vital to the identification of the pollutant stressor(s) that is impacting the benthic community of the Roanoke River. Available monitoring data included biological assessments, water quality monitoring data, and Discharge Monitoring Reports (DMR) for permitted facilities in the watershed. Biological monitoring data from 1994 to 2004 were analyzed. Instream water quality conditions were assessed primarily based on data collected at DEQ ambient monitoring stations, field data collected during biological monitoring surveys, and additional special monitoring studies. In addition, monitoring data contained in discharge monitoring reports were used to assess the impacts of the wastewater treatment facilities in the watershed.

Stressor Identification

Assessment of the primary stressor contributing to biological impairment in the Roanoke River was based on evaluations of candidate stressors that can potentially impact the river. The 2004 Water Quality Assessment 305(b)/303(d) Integrated Report Fact Sheet identified "urban nonpoint source runoff" and "sedimentation" as possible sources of impairment. Therefore, these pollutants were considered in the evaluation of candidate stressors along with other potential stressors such as nutrients, pH, temperature, ammonia, and toxic compounds. Each candidate stressor was evaluated on the basis of

available monitoring data, field observations, and consideration of potential sources in the watershed.

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- **Non-stressors**: The stressors with data indicating normal conditions and without water quality standard violations, or without any apparent impact
- **Possible stressors**: The stressors with data indicating possible links, however, with inconclusive data to show direct impact on the benthic community
- **Most probable stressors**: The stressors with the most complete data linking them to the poorer benthic community.

Metals and organics data collected in the Roanoke River show no evidence of toxicity; however, the toxicity testing results and historic stormwater monitoring data provide some qualitative evidence that toxic pulses may enter the river during storm events during the first flush. While it cannot be conclusively stated that toxicity is a most probable stressor affecting the benthic invertebrate communities, the possibility of some acute toxicity associated with stormwater flows should be further investigated, and the issues associated with elevated stormwater flows should be addressed in the implementation of the Roanoke River benthic impairment TMDL. Therefore, toxicity was classified as a possible stressor impacting benthic invertebrates in the biologically impaired segments of the Roanoke River

Based on the evidence and data evaluated, sediment was identified as the most probable stressor impacting benthic invertebrates in the biologically impaired segments of the Roanoke River. Habitat scores indicate increased substrate embeddedness and decreased habitat quality in the impaired segments as a result of the surrounding urban environment. Potential sources of sediment loading in the watershed include urban stormwater runoff, streambank erosion, and sediment loss from habitat degradation associated with urbanization.

Improvement of the benthic community in the biologically impaired segments of the Roanoke River is dependent upon controlling stormwater to reduce sediment loading from urban runoff and streambank erosion, as well as restoring instream and riparian habitat to alleviate the impacts of urbanization on the river. To address these issues, a sediment TMDL was developed for the biologically impaired segments of the Roanoke River.

Reference Watershed Approach

TMDL development requires determination of endpoints, or water quality goals/targets, for the impaired waterbody. TMDL endpoints represent stream conditions that meet water quality standards. Currently, Virginia does not have numeric criteria for sediment. Therefore, a reference watershed approach was used to establish the numeric TMDL endpoint for the Roanoke River.

The watershed draining to the DEQ biomonitoring station at river mile 224.54 on the Roanoke River was selected as the reference watershed for the Roanoke River benthic TMDL development. Reduction of sediment loading in the impaired watershed to the level determined for the reference watershed (adjusted for area) is expected to restore support of the aquatic life use for the Roanoke River.

Sediment Loading Determination

Sediment sources within the Roanoke River watershed include both point and non-point sources. Point sources include solids loading from permitted discharge facilities and land-based loading from areas covered by municipal separate storm sewer system (MS4)

WLA = Wasteload Allocation

LA = Load Allocation

MOS = Margin of Safety

The wasteload allocation represents the total sediment loading allocated to point sources. The load allocation represents the total sediment loading allocated to non-point sources. A margin of safety is applied to account for uncertainty in methodologies and determination of sediment loadings. An explicit margin of safety of 10% was used for the Roanoke River benthic TMDL.

The total wasteload allocated to the point source facilities was based on the permitted discharge loading rate for total suspended solids for each facility. Load allocations for non-point sources and wasteload allocations for the MS4s were based on an equal percent reduction from controllable sources. Loads from forested lands are considered to be representative of the natural condition and therefore were not subject to reductions. By reducing sediment loads from agricultural, transitional, and developed lands and instream erosion by 69.5%, the sediment TMDL endpoint is achieved. The TMDL for the Roanoke River is presented in Table E-1 and the recommended TMDL allocations and the percent reduction required for all watershed sources are presented in Table E-2. Table E-3 presents the sediment allocations for the permitted point source dischargers. Table E-4 depicts the sediment allocations for each MS4 permitee.

Table E-1: Sediment TMDL for Roanoke River (tons/year)

TMDL	Load Allocation	Wasteload Allocation	Margin of Safety (10%)
21,079	13,782	5,189	2,108

Table E-3: Point Sources Sediment TMDL Allocations

Facility Name	Permit Number	Annual Sediment Loads (tons/yr)	Allocated Loads (tons/yr)	Percent Reduction
Western Virginia Water Authority	VA0025020	472.2	472.2	0
Roanoke Electric Steel Corporation	VA0001589	92.9	92.9	0
Shawville Town STP	VA0024031	9.1	9.1	0
Carvin Cove Water Filtration Plant	VA0001473	17.6	17.6	0
Crystal Springs WTP	VA0091065	8.8	8.8	0
Norfolk Southern Railway Company - Shaffers Crossings	VA0001597	1.62	1.62	0
Ellison Lafayette WWTP	VA0062219	11.2	11.2	0
Blacksburg Country Club STP	VA0027481	1.57	1.57	0
Roanoke Moose Lodge	VA0077895	0.21	0.21	0
		Total Allocated Load	**615.3**	**0**

The MS4 allocations detailed in Table E-2 are broken down by MS4 Urban area and shown in Table E-4.

Table E-4: Sediment TMDL Wasteload Allocations for MS4 Urban Areas

MS4 Permit Holder	Permit Number	Sediment Allocation (Tons/Year)
Roanoke County	VAR040022	1823
City of Roanoke	VAR040004	1487
Town of Vinton	VAR040026	128
Botetourt County	VAR040023	327
City of Salem	VAR040010	589
VDOT Roanoke Urban Area	VAR040017	27
Virginia Western Community College	VAR040030	2
Virginia Medical Center	VAR040050	10
VDOT Montgomery County Urban Area	VAR040016	4
Town of Blacksburg	VAR040019	102
Town of Christianburg	VAR040025	75
	Total	**4573**

Standard (benthic impairment). This report addresses the benthic impairment; PCB and fecal coliform impairments will be addressed in separate TMDL reports. Biological assessments conducted at DEQ monitoring stations (4AROA202.20, 4AROA205.67, 4AROA206.03, 4AROA206.95) located on the Roanoke River indicate an impaired benthic macroinvertebrate community, which resulted in the Section 303(d) listing.

The headwaters of the Roanoke River originate in southwest Virginia. The Roanoke River flows through southcentral Virginia before crossing the North Carolina state line and discharging into the Albemarle Sound in North Carolina (Figure 1-1). The Roanoke River is also commonly referred to as the Staunton River prior to its confluence with the Dan River at Kerr Reservoir. The impaired benthic segments (ID #'s VAW-L04R-01 and VAW-L04R-02) are located on the mainstem Roanoke River in the upper section of the Roanoke River basin. Segment VAW-L04R-01 is 9.87 miles in length, beginning at the confluence of Mason Creek and the mainstem Roanoke River, and extending downstream to the Western Virginia Water Authority outfall on the Roanoke River. Approximately 1.46 miles of segment VAW-L04R-02 are listed for benthic impairment, beginning at the Western Virginia Water Authority outfall on the Roanoke River, and ending at the backwaters of the Niagara Dam impoundment. Figure 1-2 depicts the stream segments on the Roanoke River listed for benthic impairment, and also presents the Roanoke River watershed delineated at the downstream limit of the impaired segments.

Figure 1-2: Roanoke River Benthic Impairment Segments and Delineated Watershed

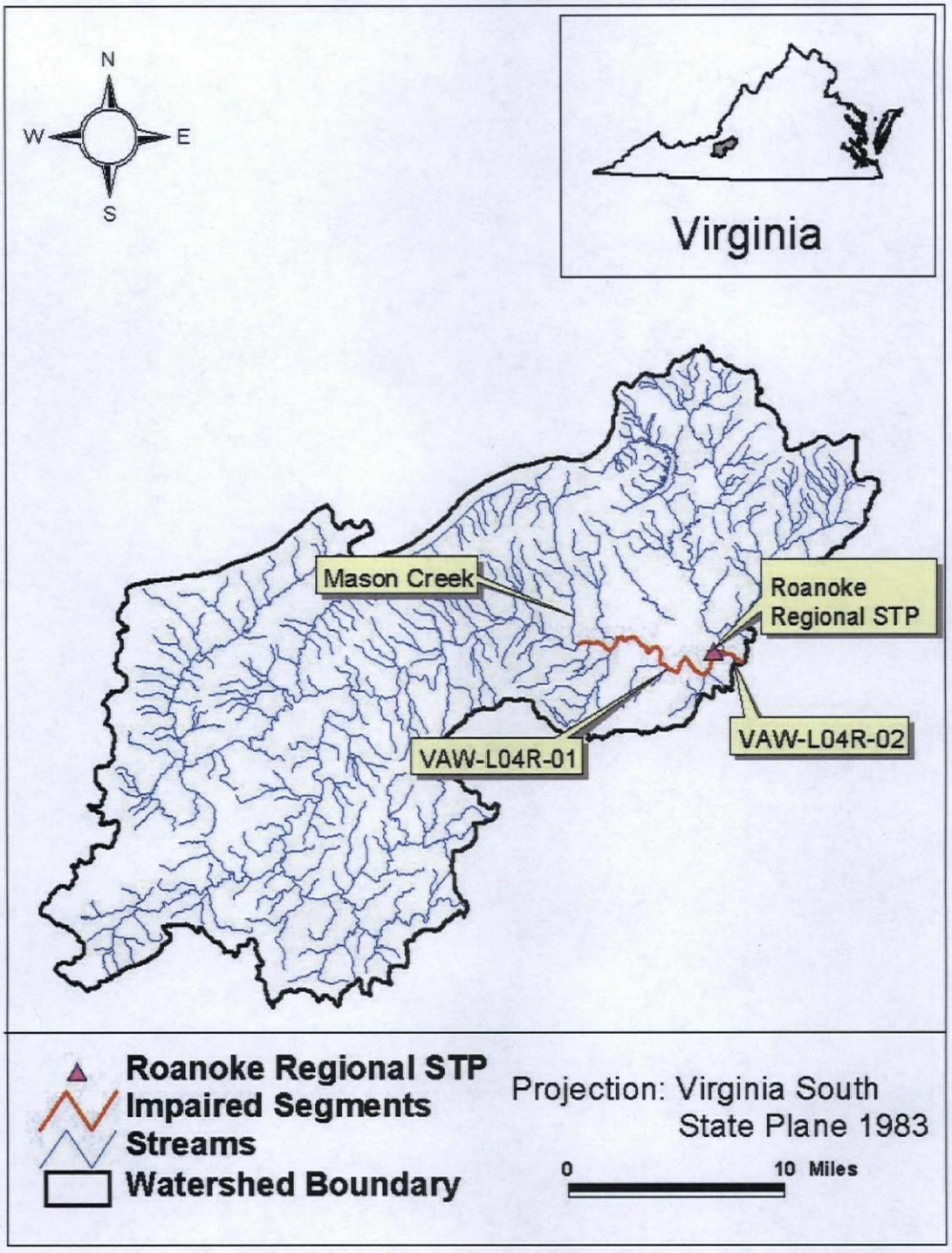
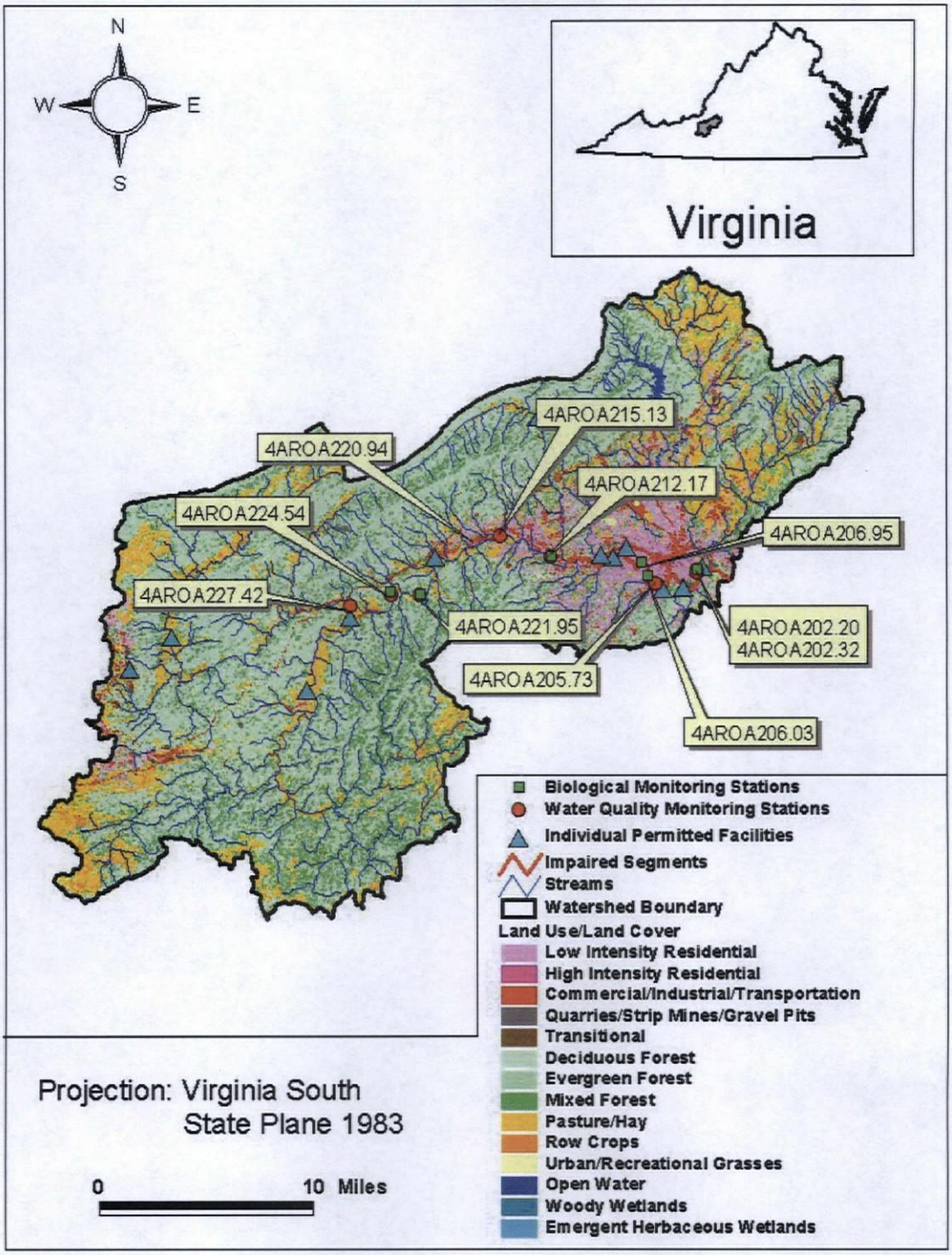


Figure 2-7: Overview of the Roanoke River Benthic Impairment Watershed



3.2.3 Organics Data

Organics data collected on the Roanoke River by DEQ include dissolved samples analyzed for Alpha, Beta, and Delta Benzene Hexachloride, Endosulfan Sulfate, Alpha Endosulfan, Endrin, Gamma-BHC, Heptachlor Epoxide, Dichlorodiphenyldichloroethane (DDD), Dichlorodiphenyldichloroethylene (DDE), and Dichlorodiphenyltrichloroethane (DDT), as well as sediment samples analyzed for numerous organics parameters. All available organics data collected on the mainstem Roanoke River were analyzed to determine whether the examined parameters complied with Virginia's established water quality standards and sediment screening values. No monitored organics parameters violated acute or chronic dissolved freshwater criteria specified in Virginia's water quality standards. Additionally, none of the available sediment organics data violated the sediment screening values specified in the DEQ 2004 assessment guidance memorandum (DEQ, 2004).

3.2.4 Toxicity Testing

Toxicity testing was performed on water samples collected from the Roanoke River by DEQ on April 12th, 14th, and 16th, 2004 at stations 4AROA202.20 and 4AROA206.95. The EPA Region 3 laboratory in Wheeling, West Virginia performed chronic toxicity testing on samples using fathead minnows and Ceriodaphnia dubia as test organisms. Results indicated Ceriodaphnia mortality and reproduction in the Roanoke River water samples were not statistically different than mortality and reproduction in the control samples, thus indicating that there were no toxic water column effects to Ceriodaphnia in the Roanoke River samples.

Fathead minnow growth in the Roanoke River water samples was also not statistically different from growth in the control samples. However, fathead minnow survival in samples collected at both station 4AROA202.20 and station 4AROA206.95 did significantly vary from minnow survival in the control samples. Minnow survival in samples collected at station 4AROA202.20 was 75% and was statistically different from the laboratory control, although the EPA Region 3 laboratory in Wheeling indicated that in their professional judgment, this result "probably did not represent a biological effect." Fathead minnow survival in samples collected at station 4AROA206.95 was 65%, also

Instream toxicity testing indicated no toxic effects on Ceriodaphnia survival and reproduction, or fathead minnow growth. However, minnow survival rates in samples collected at the two monitoring stations on the Roanoke River were statistically different than survival rates in the control samples. The EPA Region 3 laboratory in Wheeling, WV indicated that in their professional judgment, the difference in mortality rates between the sample taken at station 4AROA202.20 and the control was "probably not biologically significant", while the difference between the sample taken at station 4AROA206.95 and the control "probably was biologically significant." In both instances, the EPA Region 3 laboratory emphasized that these results were qualitative in nature, and needed to be compared to other available water quality data.

Metals and organics data collected by DEQ do not suggest the presence of toxicity in the Roanoke River. However, it should be noted that these data are typically collected under base flow and dry weather conditions, and may not capture the "first flush" of stormwater which typically carries the majority of pollutants to streams. The toxicity samples were collected by DEQ immediately following a large storm event (Jason Hill, personal communication), and therefore may have captured pollutants that had been recently flushed into the stream via stormwater runoff. While the DEQ metals and organics data indicate that there are no chronic toxicity problems in the Roanoke River, the toxicity testing results suggest the possibility of some acute toxicity after storm events. Although no recent stormwater monitoring has been conducted in the watershed, the available historical data, while limited, do show elevated metals concentrations in tributaries to the Roanoke River during storm events.

The available toxics data and toxicity testing results do not decisively prove or disprove that toxicity is adversely impacting benthic invertebrates in the Roanoke River. Metals and organics data collected in the Roanoke River show no evidence of toxicity; however, the toxicity testing results and historic stormwater monitoring data provide some qualitative evidence that toxic pulses may enter the river during storm events. While it cannot be conclusively stated that toxicity is a primary stressor impacting the benthic invertebrate communities, the possibility of some acute toxicity associated with stormwater flows should be further investigated, and the issues associated with elevated

APPENDIX D: General Permit & Individual Permit Stormwater TMDL Allocations

The TSS allocation for each permitted facility was calculated using a DEQ assigned TSS concentration and the corresponding runoff amount generated on the site based on the facility area or the facility discharge. The TSS allocated load for each permit type was calculated as follows:

- For individual permitted facilities, the allocated load was calculated based on a TSS concentration of 100 mg/L, the facility area, and 72.54 cm of runoff per year. The annual average runoff of 72.54 cm corresponds to an annual average rainfall of 40.8 inches (103.63 cm) and an industrial land cover with 70 percent imperviousness.
- For general stormwater permits issued to industrial facilities, the allocated load was calculated based on a TSS concentration of 100 mg/L, the facility area, and 72.54 cm of runoff per year.
- For general permits issued to domestic sewage facilities, the allocated load was calculated based on a TSS concentration of 30 mg/L and a flow value of 1,000 gallons per day.
- For general permits issued to mines, the allocated load was calculated based on a TSS concentration of 30 mg/L, the facility area, and 45.9 cm of runoff per year.
- For general permits issued to concrete facilities, the allocated load was calculated based on a TSS concentration of 30 mg/L, the facility area, and 72.54 cm of runoff per year.
- For general stormwater permits issued to carwashes, the allocated load was calculated based on a TSS concentration of 60 mg/L, the facility area, and 72.54 cm of runoff per year.
- For general stormwater permits issued to construction sites, the total allocated load was calculated based on a per acre loading unit of 10.97 metric tons of sediment per hectare, the disturbed construction area, and a sediment delivery ratio of 0.136. Table D-7 depicts the combined sediment load from all construction sites based on an average annual disturbed area of 467 acres. The average annual acreage of 467 acres was derived using information from the VADEQ Comprehensive Environmental Database System (CEDS) database for the period of 2002 to 2004.

Table D-1: Stormwater TMDL Allocations for Individual Permitted Facilities

Permit Number	Facility	TSS Stormwater Allocation (tons/yr)
VA0001252	Associated Asphalt Inc.	2.78
VA0001333	Koppers Inc.	18.24
VA0001589	Roanoke Electric Steel Corp.	56.55
VA0001511	Norfolk Southern Railway Co - East End Shops	35.70
VA0001597	Norfolk Southern Railway Co. - Shaffers Crossing	28.83
VA0025020	Western Virginia Water Authority	34.17
VA0088358	Fred Whitaker Co.	0.97
VA0089991	Federal Mogul Corp.	12.30

Table D-2: TMDL Allocations for General Stormwater Permits Issued to Industrial Facilities

Permit Number	Facility	Receiving Waterbody	MS4 Area	TSS Allocation (tons/yr)
VAR050027	Auto Salvage & Sales, Inc.	Tinker Creek	Roanoke City	0.53
VAR050134	Greater Roanoke Transit Company	Lick Run	Roanoke City	0.81
VAR050135	Virginia Scrap Iron & Metal Company Inc	Roanoke River	Roanoke City	1.66
VAR050143	Virginia Scrap Iron & Metal Incorporated	Roanoke River	Roanoke City	1.66
VAR050144	North 11 Asphalt Plant - Roanoke	Carvins Creek	Roanoke City	27.43
VAR050145	Holland-Richards Vault Service	Mason Creek	Roanoke City	0.25
VAR050178	BFI Waste Systems LLC - Roanoke	Roanoke River	Roanoke City	0.63
VAR050207	1915 Plantation Rd LLC	Lick Run	Roanoke City	0.63
VAR050208	Walker Machine & Foundry Corp	Roanoke River	Roanoke City	2.40
VAR050272	Roanoke Regional Airport	Deer Creek	Roanoke City	179.22
VAR050273	Ralph Smith Inc Steel Fabrication	Roanoke River UT	Roanoke City	0.67
VAR050274	USPS Roanoke Vehicle Maintenance Service	Roanoke River	Roanoke City	3.56
VAR050275	Old Dominion Auto Salvage	Tinker Creek	Roanoke City	3.46
VAR050436	Norfolk Southern Corp - Roadway Material Yard	Roanoke River	Roanoke City	0.49
VAR050437	Estes Express Lines Incorporated	Roanoke River, UT	Roanoke City	2.33
VAR050460	Yellow Freight System Inc	Tinker Creek	Roanoke City	1.62
VAR050496	Federal Express Corp - ROAA Station	Lick Run	Roanoke City	1.69
VAR050516	Mennel Milling Company	Roanoke River	Roanoke City	0.32
VAR050519	FedEx Freight East, Inc.	UT to Lick Run	Roanoke City	1.73
VAR050520	O'Neal Steel Inc	Tinker Creek	Roanoke City	6.46
VAR050522	Progress Rail Services Corp - Roanoke	Roanoke River	Roanoke City	3.95

FINAL

Roanoke River PCB TMDL Development (Virginia)

Roanoke (Staunton River) Watershed

December 2009

Prepared for:
United States Environmental Protection Agency, Region 3
Contract EP-C-08-004, Task Order #2008-041

EPA Approved 4/9/10
SWCB Approved 12/9/10

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EXECUTIVE SUMMARY

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA's) Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. A TMDL establishes the amount of a pollutant that a waterbody can assimilate without exceeding its water quality standard for that pollutant. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point sources and nonpoint sources to restore and maintain the quality of the state's water resources.

A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. The TMDL components are illustrated using the following equation:

$$TMDL = ? \; WLAs + ? \; LAs + MOS$$

The objective of the Roanoke River PCB TMDL study is to identify the sources of Polychlorinated Biphenyl (PCB) contamination in the watershed and determine the reductions in pollutant loadings necessary to achieve the applicable water quality standards. The TMDL study drainage area is approximately 2,379 square miles and includes two sections of the Roanoke River watershed—from its headwaters downstream to Niagra Dam (upper Roanoke) and from Leesville Dam downstream to its confluence with the Dan River [lower Roanoke (Staunton)]. The mainstem lengths of the upper and lower sections of the river are approximately 29 and 96 miles, respectively, and run through several Virginia counties, including Montgomery, Roanoke, Bedford, Franklin, Campbell, Pittsylvania, Charlotte, and Halifax.

The impairment listings for stream and reservoir segments in the study area are based on the historical fish tissue and sediment monitoring data record. This TMDL study was designed to address select PCB impairments included on Virginia's 1998 303(d) list. More recent monitoring studies have resulted in the listing of additional PCB-impaired stream and reservoir segments in the watershed, including updates on Virginia's 2008 303(d) list (Table ES-1) and a forthcoming violation listing (2010) of the public water supply use. The framework developed for these TMDLs does not include allocations for impaired segments outside of the study watersheds described above. It does include allocations for all stream segments in the study area, however, and if no other significant sources of PCBs are found, it can be assumed that these TMDLs will significantly improve the more recent PCB impairment listings, as well.

Table ES-1. 2008 303(d) PCB impaired segments

Waterbody	Impaired segment description	County/city	Miles/acres[b]	Initial listing[b]	2008 303(d) list ID
Roanoke River	Near Dixie Caverns – Mason Creek confluence	Roanoke, City of Salem, City of Roanoke	12.88 miles	2002	L12L-01-PCB
Roanoke River	Mason Creek confluence – Back Creek mouth	City of Salem, City of Roanoke	15.47 miles	1996	
Peters Creek	Peters Creek headwaters – Roanoke River confluence	Roanoke, City of Roanoke	7.17 miles	2004	
Tinker Creek	Deer Branch confluence – Roanoke River confluence	Roanoke, City of Roanoke	5.35 miles	2006	
Smith Mountain Lake[a]	Back Creek mouth – Smith Mountain Lake Dam (includes Blackwater arm up to Rt. 122 bridge)	Bedford, Franklin	17,157 acres	2002	

Waterbody	Impaired segment description	County/city	Miles/acres[b]	Initial listing[b]	2008 303(d) list ID
Blackwater River[a]	Maggodee Creek confluence – Blackwater River arm of Smith Mountain Lake	Franklin	11.43 miles	2006	
Staunton (Roanoke) River	Leesville Dam – Pipeline crossing 5.4 miles downstream of Rt. 360 bridge	Charlotte, Halifax, Campbell, Pittsylvania	83.9 miles	1998	L19R-01-PCB
Staunton (Roanoke) River	Pipeline crossing 5.4 miles downstream of Rt. 360 bridge – Kerr Reservoir	Halifax, Charlotte	4.49 miles	1998	
Cub Creek	Rough Creek Rd. – Roanoke River confluence	Charlotte	14.25 miles	2008	
Little Otter River	West of Rt. 680 at Cobbs Mountain – mouth of the Little Otter River on the Big Otter River	Bedford	14.36 miles	2002	L26R-01-PCB

a. These segments are not included in the TMDL study area
b. Source: http://www.deq.state.va.us/wqa/ir2008.html

TMDL reductions were calculated on the basis of meeting water quality targets in the upper and lower sections of the Roanoke (Staunton). Water quality targets were derived from Bioaccumulation Factors (BAF) and the Virginia Department of Environmental Quality (VADEQ) fish tissue criterion for total PCBs (tPCBs). BAFs allow for the back-calculation of a water concentration equivalent from a fish tissue concentration, in this case a threshold level of 54 parts per billion (ppb). Two endpoints were developed corresponding to the upper [390 picograms per liter (pg/L)] and lower (140 pg/L) sections of the Roanoke (Staunton) River basin on the basis of the available water quality and fish tissue monitoring data. The decision to evaluate the upper and lower sections separately was made because of the large reservoirs that separate them and the differences in the magnitude and composition of PCB contamination.

The TMDL endpoints have been developed to be protective of fish for human consumption and are more stringent than the 1,700 pg/L state criterion for human health. The human health criterion applies to waterbodies used for public water supply, in addition to all other surface waters. The TMDL endpoints, therefore, are more than adequate to protect the water supply use and address the forth coming violation listing (2010) of the public water supply use in the Roanoke River watershed.

A watershed modeling framework, consisting of the Loading Simulation Program C++ (LSPC) with sediment PCB modeling enhancements was developed, calibrated, and validated for the Roanoke River study watershed. LSPC is a dynamic watershed model that generates precipitation-driven simulation of time-variable flow and water quality. The LSPC model was configured to simulate PCBs in both the dissolved- and sediment-associated states. Sediment-associated PCB loading and in-stream transport, deposition, burial and resuspension processes, along with partitioning of PCBs in the water and sediment layer were incorporated into the model simulations. A summary of the TMDLs, LAs, and WLAs developed for streams in the Roanoke River watershed is presented in Table ES-2. Streams listed as impaired for PCBs on Virginia's 2008 303(d) list are identified by their associated list ID. A summary of the TMDLs, LAs, and WLAs by source category is presented in Table ES-3.

Table ES-2. Average annual tPCBs TMDLs for Roanoke River watershed streams

Stream	2008 303(d) list ID	Baseline (mg/yr)	WLA (mg/yr)	LA (mg/yr)	MOS (mg/yr)	TMDL (mg/yr)	% Reduction
Upper Roanoke River							
North Fork Roanoke River	Not listed	4,923.2	28.2	630.3	34.7	693.2	85.9
South Fork Roanoke River	Not listed	3,532.2	230.2	788.6	53.6	1,072.5	69.6
Masons Creek	Not listed	1,777.5	9.1	193.2	10.6	212.9	88.0

Stream	2008 303(d) list ID	Baseline (mg/yr)	WLA (mg/yr)	LA (mg/yr)	MOS (mg/yr)	TMDL (mg/yr)	% Reduction
Peters Creek	L12L-01-PCB	1,742.6	65.4	31.2	5.1	101.7	94.2
Tinker Creek	L12L-01-PCB	16,593.6	103.9	3,414.2	185.2	3,703.2	77.7
Wolf Creek	Not listed	1,078.4	10.0	20.3	1.6	31.9	97.0
Unnamed Trib to Roanoke River	Not listed	59.4	0.5	1.3	0.1	1.9	96.8
Roanoke River	L12L-01-PCB	133,207.2	28,157.7	3,455.7	1,663.9	33,277.3	75.0
Upper Total		**162,914.1**	**28,605.0**	**8,534.8**	**1,954.7**	**39,094.5**	**76.0**
Lower Roanoke (Staunton) River							
Goose Creek	Not listed	5,400.9	0.1	1,812.4	95.4	1,907.9	64.7
Sycamore Creek	Not listed	93,226.4	1.4	186.3	9.9	197.6	99.8
Lynch Creek	Not listed	7,670.6	0.1	17.8	0.9	18.8	99.8
Reed Creek	Not listed	253.4	0.0	75.9	4.0	79.9	68.5
X-trib	Not listed	215,127.2	0.1	1.3	0.1	1.5	100.0
Unnamed Trib to Roanoke River	Not listed	12,848.6	0.1	19.1	1.0	20.2	99.8
Little Otter River	L26R-01-PCB	3,934.3	0.0	596.2	31.4	627.6	84.0
Big Otter River	Not listed	7,630.9	0.0	2,462.8	129.6	2,592.4	66.0
Straightstone Creek	Not listed	464.8	0.0	279.0	14.7	293.7	36.8
Seneca Creek	Not listed	692.9	0.0	400.8	21.1	421.9	39.1
Whipping Creek	Not listed	398.4	0.0	157.7	8.3	166.0	58.3
Falling River	Not listed	4,135.2	0.0	1,746.5	91.9	1,838.4	55.5
Childrey Creek	Not listed	390.2	0.0	201.3	10.6	211.9	45.7
Catawba Creek	Not listed	168.8	0.0	94.8	5.0	99.8	40.9
Turnip Creek	Not listed	376.2	0.0	272.6	14.3	286.9	23.7
Hunting Creek	Not listed	86.6	0.0	65.2	3.4	68.6	20.7
Cub Creek	L19R-01-PCB	1,376.7	0.0	997.4	52.5	1,049.9	23.7
Black Walnut Creek	Not listed	181.9	0.8	46.5	2.5	49.7	72.7
Roanoke Creek	Not listed	2,446.8	0.0	1,429.6	75.2	1,504.8	38.5
Difficult Creek	Not listed	823.2	0.0	462.1	24.3	486.5	40.9
Roanoke River	L19R-01-PCB	239,207.9	1,931.8	11,961.7	731.2	14,624.8	93.9
Lower Total		**596,841.9**	**1,934.3**	**23,287.0**	**1,327.4**	**26,548.8**	**95.6**

Table ES-3. Average annual tPCBs TMDLs for Roanoke River source categories

Source Category	Baseline (mg/yr)	WLA (mg/yr)	LA (mg/yr)	% Reduction[a]
Upper Roanoke River				
VPDES Dischargers	17,665.8	28,267.1		-60.0
Individual Industrial/General Permits	6,827.4	5.3		99.9
MS4	109,622.4	332.7		99.7
Contaminated Sites	7,853.5		1.0	100.0
Urban background (unknown sites)	12,082.4		114.4	99.1
Atmospheric Deposition	8,862.5		8,419.4	5.0
Total	**162,914.1**	**28,605.0**	**8,534.8**	**77.2**
Lower Roanoke (Staunton) River				
VPDES Dischargers	78,305.9	1,926.7		97.5

Waterbody	Impaired segment description	County/city	Miles/acres[b]	Initial listing[b]	2008 303(d) list ID
Blackwater River[a]	Maggodee Creek confluence – Blackwater River arm of Smith Mountain Lake	Franklin	11.43 miles	2006	
Staunton (Roanoke) River	Leesville Dam – Pipeline crossing 5.4 miles downstream of Rt. 360 bridge	Charlotte, Halifax, Campbell, Pittsylvania	83.9 miles	1998	L19R-01-PCB
Staunton (Roanoke) River	Pipeline crossing 5.4 miles downstream of Rt. 360 bridge – Kerr Reservoir	Halifax, Charlotte	4.49 miles	1998	
Cub Creek	Rough Creek Rd. – Roanoke River confluence	Charlotte	14.25 miles	2008	
Little Otter River	West of Rt. 680 at Cobbs Mountain – mouth of the Little Otter River on the Big Otter River	Bedford	14.36 miles	2002	L26R-01-PCB

a. These segments are not included in the TMDL study area
b. Source: http://www.deq.state.va.us/wqa/ir2008.html

TMDL reductions were calculated on the basis of meeting water quality targets in the upper and lower sections of the Roanoke (Staunton). Water quality targets were derived from Bioaccumulation Factors (BAF) and the Virginia Department of Environmental Quality (VADEQ) fish tissue criterion for total PCBs (tPCBs). BAFs allow for the back-calculation of a water concentration equivalent from a fish tissue concentration, in this case a threshold level of 54 parts per billion (ppb). Two endpoints were developed corresponding to the upper [390 picograms per liter (pg/L)] and lower (140 pg/L) sections of the Roanoke (Staunton) River basin on the basis of the available water quality and fish tissue monitoring data. The decision to evaluate the upper and lower sections separately was made because of the large reservoirs that separate them and the differences in the magnitude and composition of PCB contamination.

The TMDL endpoints have been developed to be protective of fish for human consumption and are more stringent than the 1,700 pg/L state criterion for human health. The human health criterion applies to waterbodies used for public water supply, in addition to all other surface waters. The TMDL endpoints, therefore, are more than adequate to protect the water supply use and address the forth coming violation listing (2010) of the public water supply use in the Roanoke River watershed.

A watershed modeling framework, consisting of the Loading Simulation Program C++ (LSPC) with sediment PCB modeling enhancements was developed, calibrated, and validated for the Roanoke River study watershed. LSPC is a dynamic watershed model that generates precipitation-driven simulation of time-variable flow and water quality. The LSPC model was configured to simulate PCBs in both the dissolved- and sediment-associated states. Sediment-associated PCB loading and in-stream transport, deposition, burial and resuspension processes, along with partitioning of PCBs in the water and sediment layer were incorporated into the model simulations. A summary of the TMDLs, LAs, and WLAs developed for streams in the Roanoke River watershed is presented in Table ES-2. Streams listed as impaired for PCBs on Virginia's 2008 303(d) list are identified by their associated list ID. A summary of the TMDLs, LAs, and WLAs by source category is presented in Table ES-3.

Table ES-2. Average annual tPCBs TMDLs for Roanoke River watershed streams

Stream	2008 303(d) list ID	Baseline (mg/yr)	WLA (mg/yr)	LA (mg/yr)	MOS (mg/yr)	TMDL (mg/yr)	% Reduction
Upper Roanoke River							
North Fork Roanoke River	Not listed	4,923.2	28.2	630.3	34.7	693.2	85.9
South Fork Roanoke River	Not listed	3,532.2	230.2	788.6	53.6	1,072.5	69.6
Masons Creek	Not listed	1,777.5	9.1	193.2	10.6	212.9	88.0

1. INTRODUCTION AND BACKGROUND

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA's) Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not supporting their designated uses even if pollutant sources have implemented technology-based controls. A TMDL establishes the maximum allowable pollutant load that a waterbody is able to assimilate and still achieve its designated use(s). The maximum allowable load is determined on the basis of the relationship between pollutant sources and in-stream water quality. A TMDL provides the scientific basis for a state to establish water quality-based controls to reduce pollution from both point sources and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991). The development of TMDLs requires an assessment of the waterbody's assimilative capacity, critical conditions, and other considerations.

Virginia's 2008 section 303(d) list classifies several waterbodies in the Roanoke River basin as impaired for Polychlorinated Biphenyls (PCB) from elevated PCB concentrations found in fish tissue and sediment samples. The Virginia Department of Environmental Quality (VADEQ) first collected monitoring data on PCB contamination in the basin in 1971. Regular fish tissue and sediment sampling for PCBs began in 1993, and a rotating basin monitoring schedule is ongoing as part of the Statewide Fish Tissue and Sediment monitoring program. The Virginia Department of Health (VDH) has issued fish consumption advisories for several sections of the Roanoke River and tributaries since 1998 on the basis of the fish tissue data collected by VADEQ.

Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters that do not meet water quality standards. The objective of the Roanoke PCB TMDL study is to identify the sources of PCB contamination in the watershed and to determine the reductions required to achieve water quality standards for PCB impaired segments.

PCBs are a group of synthetic chemicals that consist of 209 individual compounds (known as congeners). Physically, they are either oily liquids or solids and are colorless to light yellow in color with no known smell or taste. PCBs made in the United States were marketed under the trade name Aroclor and most are identified by a four-digit numbering code in which the first two digits indicate that the parent molecule is a biphenyl. Each of the 209 possible PCB compounds consists of two sigma bonded, chlorine substituted phenyl groups. Individual PCB congeners differ in the number and position of the chlorine substituents. PCBs possess excellent dielectric and flame-resistant properties derived from their stable molecular structure. These same properties cause PCBs to accumulate in the fatty tissue of biota and bioaccumulate in the food chain (http://www.epa.gov/ttn/atw/hlthef/polychlo.html).

Although it is now illegal to manufacture, distribute, or use PCBs, before 1974 they were used in numerous products including, capacitors, transformers, plasticizers, surface coatings, inks, adhesives, pesticide extenders, paints, carbonless duplicating paper, etc. After 1974, PCB use was restricted to producing capacitors and transformers, and in 1979 the manufacture and use of PCBs was completely banned. Historically, PCBs had been introduced into the environment through discharges from point sources and through spills and releases. Although point source contributions are now controlled, facilities could be unknowingly discharging PCB loads as a result of historical contamination. Sites with PCB-contaminated soils can also act as precipitation-driven nonpoint sources. In addition, the widespread use of PCBs before their ban coupled with their stable molecular structure has caused a generalized distribution of the pollutant in air, soil, and water at background concentrations. Once in a waterbody, PCBs become associated with sediment particles. PCBs are very resistant to breakdown and thus remain in river and lake sediments for many years.

PCB concentrations in environmental media tend be very small, particularly in water due to its hydrophobic properties. Throughout the remainder of this document the units presented in Table 1-1 are used to describe PCB concentrations in fish tissue, sediments, and water.

Table 1-1. Common PCB concentration units and abbreviations

Media	Unit	Unit abbreviation	Parts-per description	Part-per abbreviation
Fish tissue, sediment	micrograms per kilogram	µg/kg	parts per billion	ppb
Water	micrograms per liter	µg/L	parts per billion	ppb
	picograms per liter	pg/L	parts per quadrillion	ppq

1.1. Watershed Description

The Roanoke River watershed drains a largely rural area of the coastal plain from the eastern edge of the Appalachian Mountains in southern Virginia, southeast across the Piedmont to the Albemarle Sound in northeastern North Carolina. The drainage area of the Roanoke River from its headwaters to the Dan River confluence is approximately 3,343 square miles with a length of approximately 227 miles, spanning three physiographic provinces along its course.

Moving southeast from the headwaters, these include the Valley and Ridge, Blue Ridge, and Piedmont. The river also crosses through several Virginia counties—including Montgomery, Roanoke, Franklin, Bedford, Pittsylvania, Campbell, Halifax, and Charlotte—in addition to two reservoirs, Smith Mountain Lake and Leesville Lake. The major tributaries to the Roanoke River, in downstream order, are the North and South Fork Roanoke River, Mason Creek, Peters Creek, Tinker Creek, Back Creek, Falling Creek, Blackwater River, Pigg River, Goose Creek, Sycamore Creek, Lynch Creek, Big Otter River, Seneca Creek, Falling River, Catawba Creek, Turnip Creek, Cub Creek, Roanoke Creek, and Difficult Creek.

The TMDL study area includes two sections of the Virginia portion of the watershed beginning at the river headwaters in the Blue Ridge Mountains downstream to Niagra Dam about 1.5 miles east of the city of Roanoke (upper Roanoke) and from Leesville Dam downstream to its confluence with the Dan River at approximately river mile 46 [lower Roanoke (Staunton)] (Figure 1-1). For the remainder of this document when the Roanoke River watershed/basin is discussed, it is in reference to the TMDL study portion of the watershed. Figure 1-2 presents the general location and major streams and lakes of the Roanoke River watershed and the TMDL study area.

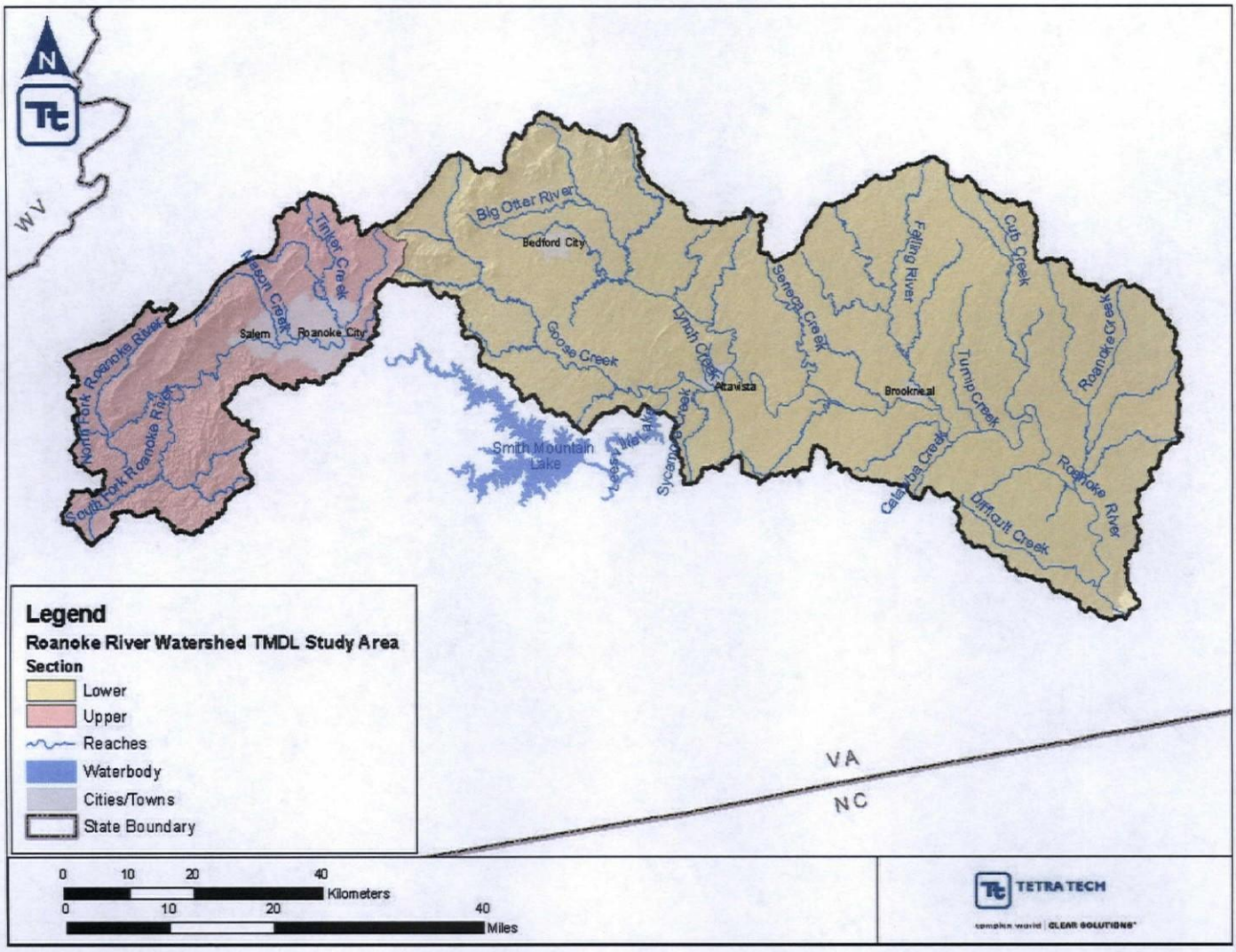

Figure 1-1. Roanoke River basin sections.

indicated a persistent presence of PCBs. In late 1992, the Virginia Department of Health (VDH) recommended collecting additional fish in the Roanoke basin to better characterize the extent of the contamination. SWCB conducted an extensive fish tissue study from February to August 1993 and issued a final report in June 1996 that concluded the occurrence of PCBs in resident fish species was widespread.

Under a Memorandum of Understanding between VADEQ and VDH, all fish tissue data generated by the Virginia Fish Tissue and Sediment Contaminants Monitoring Program are provided to VDH. VDH reviews the data and provides recommendations to VADEQ regarding the need for follow-up tissue studies and whether there is a potential unacceptable risk to human consumers. VDH uses a fish tissue contaminant screening level to determine potential risk. If fish tissue sample contaminant concentrations exceed the screening level, a fish consumption advisory is issued for the affected waterbodies. Where VDH issues a fishing ban or advisory, limiting consumption, the waterbody is designated as either partially or not supporting for fish consumption use based on the severity of the advisory. An advisory limiting fish consumption is considered partially supporting and an advisory prohibiting consumption is considered not supporting the fish consumption use (VADEQ n.d.).

The first PCB fish consumption advisory for basin waters was issued on July 24, 1998, for a segment of the Roanoke (Staunton) River beginning 29 miles below Leesville Dam and extending downstream to the Kerr Reservoir. The health advisory was issued on the basis of monitoring results from a 1998–1999 study that showed fish tissue PCB concentrations in the advisory area to be greater than the formerly applicable screening level of 600 parts per billion (ppb). On December 2, 1999, the fish consumption advisory was expanded to include the 29-mile segment upstream to the Leesville Dam.

On the basis of results of sampling studies conducted in 2000 and 2002, consumption advisories for the basin were expanded again on October 29, 2003 to include the segment of the Roanoke River from the Niagara Dam downstream to Smith Mountain Lake (Smith Mountain Lake segment). The most recent modifications (August 31, 2007) to the spatial extent of fish consumption advisories for the Roanoke River basin were a result of VDH adopting tiered screening levels that specify a *do not eat* PCB concentration threshold of 500 ppb and a limited consumption (fewer than two 8 ounce meals a month) PCB concentration range between 50 and 500 ppb and additional monitoring efforts by the state. Stream segments in the basin under fish consumption advisories include the following:

- Roanoke River (upper section): From the confluence of the North and South Forks of the Roanoke River (near the Lafayette gaging station) downstream to the Niagara dam, including tributaries Peters Creek upstream to the Route 460 bridge crossing, and Tinker Creek upstream to the confluence with Deer Branch (near Route 115).
- Roanoke River/Smith Mountain Lake: From the Niagara dam downstream to Smith Mountain Dam, including the Blackwater River arm of Smith Mountain Lake upstream to the Route 122 bridge.
- Roanoke (Staunton) River: From below Leesville Dam downstream to the confluence with Dan River including Cub Creek up to Rough Creek Road (State Route 695).

This TMDL study was designed to address select PCB impairments included on Virginia's 1998 303(d) list. The collection of additional fish tissue and sediment data since 1993 has resulted in a growing list of river and lake segments that are considered impaired for human health and aquatic life concerns, including updates on Virginia's 2008 303(d) list and a forthcoming violation listing (2010) of the public water supply use in the watershed. Table 1-2 and Figure 1-3 show the VADEQ 1998 and 2008 303(d) PCB impaired segments and the current VDH fish consumption advisory segments (as of August 31, 2007)

Stream	Point sources			Stormwater dischargers[a]			MS4s		
	Baseline (mg/yr)	WLA (mg/yr)	% Reduction[b]	Baseline (mg/yr)	WLA (mg/yr)	% Reduction[b]	Baseline (mg/yr)	WLA (mg/yr)	% Reduction[b]
Roanoke River[e]	78,305.9	1,926.7	97.5	82,724.2	5.1	100.0	0.0	0.0	0.0
Lower Total	**78,305.9**	**1,926.7**	**97.5**	**388,012.2**	**7.5**	**100.0**	**11.7**	**0.1**	**99.3**

a. Stormwater loads were assigned to streams based on the spatial orientation of the permitted area within the subbasin network
b. WLA percent reductions differ from TMDL percent reductions because they do not include an MOS load
c. 2008 303(d) segment L12L-01-PCB
d. 2008 303(d) segment L26R-01-PCB
e. 2008 303(d) segment L19R-01-PCB

Table 6-4. Point source tPCBs WLAs

Stream	NPDES ID	Facility	Pipe	Baseline (mg/yr)	WLA (mg/yr)	% Reduction[a]
Upper Roanoke River						
North Fork Roanoke River	VA0027481	Blacksburg Country Club	1	10.7	17.8	-66.3
North Fork Roanoke River Total				**10.7**	**17.8**	**-66.3**
South Fork Roanoke River	VA0062219	Montgomery County PSA - Elliston Lafayette WWTP	1	38.5	127.0	-229.6
South Fork Roanoke River	VA0024031	Montgomery County PSA - Shawsville STP	1	29.9	101.6	-239.6
South Fork Roanoke River Total				**68.4**	**228.6**	**-234.0**
Peters Creek	VA0001589	Steel Dynamics	5	90.7	50.8	44.0
Peters Creek Total[b]				**90.7**	**50.8**	**44.0**
Roanoke River	VA0025020	WVWA Roanoke Regional Water Pollution Control Plant	1	17,491.1	27,934.4	-59.7
Roanoke River	VA0001597	Norfolk Southern Railway Co - Shaffers Crossing	2	4.8	35.6	-642.0
Roanoke River Total[b]				**17,495.9**	**27,969.9**	**-59.9**
Upper Total				***17,665.8***	***28,267.1***	***-60.0***
Lower Roanoke (Staunton) River						
Roanoke River	VA0083097	Old Dominion Clover Power Station	1	197.4	319.3	-61.8
Roanoke River	VA0022241	Brookneal Town - Staunton River Lagoon	1	8.2	14.4	-74.2
Roanoke River	VA0001538	Dan River, Inc- Brookneal	1	474.8	244.1	48.6
Roanoke River	VA0083402	Old Dominion Altavista Power Station	1	22.7	21.5	5.0
Roanoke River	VA0020451	Town of Altavista-STP	1	21,311.1	662.6	96.9
Roanoke River	VA0083399	Old Dominion Pittsylvania Power Station	1	21.3	35.3	-66.0
Roanoke River	VA0001678	ITG Burlington Ind. LLC Hurt Plant	1	56,270.5	629.5	98.9
Roanoke River Total[c]				**78,305.9**	**1,926.7**	**97.5**
Lower Total				***78,305.9***	***1,926.7***	***97.5***

a. WLA percent reductions differ from TMDL percent reductions because they do not include an MOS load
b. 2008 303(d) segment L12L-01-PCB
c. 2008 303(d) segment L19R-01-PCB

Table 6-5. Permitted stormwater dischargers tPCBs WLAs[a]

Stream	NPDES ID[b]	Stormwater discharger	Baseline (mg/yr)	WLA (mg/yr)	% Reduction[c]
Upper Roanoke River					
North Fork Roanoke River	VAR050204	Wolverine Advanced Materials	12.70	0.12	99.050
North Fork Roanoke River	VAR051352	MRSWA Solid Waste Transfer Station MRF	54.91	0.52	99.050

Site name	NPDES ID	County/city	Receiving stream	Area (acres)	Contamination level
Tinker-American Electric Power (AEP) property		Roanoke City	Roanoke River	23	Moderate
Riverdale Development (formerly American Viscose Co.)	VRP00394[d]	Roanoke City	Roanoke River	81.1	Moderate
Appalachian Power Co. (APCO) Yard		Roanoke City	Roanoke River	0.8	Moderate
Jacob Webb		Roanoke City	Roanoke River	5.5	Moderate
Lower Roanoke (Staunton) River					
Burlington Industries-Altavista[b]	VA0001678	Pittsylvania	Sycamore Creek	116.3	Moderate
English Construction		Pittsylvania	Roanoke (Staunton) River	12	Moderate
West town dump-Altavista		Campbell	Lynch Creek	28	Moderate
Oil distributors-Altavista		Campbell	Lynch Creek	5.7	Moderate
Lane Furniture Co.		Campbell	Roanoke (Staunton) River	49.6	Moderate
BGF Industries[b]		Campbell	Roanoke (Staunton) River unnamed tributary	20.6	High
East town Dump-Altavista		Campbell	Roanoke (Staunton) River	14.5	Moderate
Altavista STP	VA0020451	Campbell	Roanoke (Staunton) River	25.6	Moderate
A. O. Smith		Campbell	Roanoke (Staunton) River unnamed tributary	7.7	Moderate
Schrader Bridgeport[b]		Campbell	Roanoke (Staunton) River unnamed tributary	16	Moderate
Dan River, Inc.	VA0001538	Campbell	Roanoke (Staunton) River	37.7	Moderate

a. The site acreage and contamination levels are those used in the model. It should be noted that these data are based on best available information during the PCB Source investigation. Both acreage and contamination levels are estimated with emphasis on the boldfaced sites.
b. Where a contaminated site is covered by a stormwater permit, the source is considered a stormwater site for TMDL purposes (see *Point Sources* in Section G2.3.2)
c. EPA Superfund ID#
d. Virginia Voluntary Remediation Program (VRP) site#

Unidentified contaminated sites are represented in the model by a tPCBs potency factor assigned to urban land uses in the watershed. The available PCB sediment monitoring data record was used as a surrogate to estimate the PCB concentration of TSS loads from the areas. The sediment monitoring record was aggregated by watershed section, and the median concentration was assigned to generally represent the PCB concentration of upland soils. The potency factor calculated for the upper and lower sections, 6.8 and 4.9 parts per billion (ppb), are well below the currently applicable Toxic Substances Control Act PCB cleanup levels for high-occupancy areas (1 ppm) (USEPA 2005).

Point Sources

PCB point sources for the TMDLs include traditional facility effluent, MS4s, and sites permitted for stormwater discharges. VADEQ provided an inventory of the three types of point sources to be included in the Roanoke River watershed model. The methods used to represent PCB loads from those sources are discussed below.

Facilities found to be discharging PCB-contaminated effluent as part of the 2005–2008 Special Study monitoring are represented as PCB point sources in the model. Baseline tPCB loadings were derived using a mean effluent flow rate generated using Discharge Monitoring Reports (DMRs) and tPCB concentrations set at the mean concentration calculated from the Special Study data set. Several additional facilities that were not part of the Special Study were included as PCB point sources at the request of

VADEQ. For the TMDL condition, the facility design flow was used along with the water quality target calculated for the watershed section in which the facility is located—390 picograms per liter (pg/L) for the upper and 140 pg/L for the lower—to represent facility tPCB loads. Facilities represented as PCB point sources and associated information including NPDES ID, mean monthly flow, and model represented effluent PCB concentration are presented in Table G2-8.

Table G2-8. Model PCB point source dischargers

NPDES facility name	Facility type	NPDES ID	Outfall	Mean monthly flow (mgd)	Mean PCB conc. (pg/L)
Upper Roanoke River					
Blacksburg Country Club	Sewerage systems	VA0027481	001	0.02	390
Montgomery County PSA - Shawsville Sewage Treatment Plant	Sewerage systems	VA0024031	001	0.06	390
Montgomery County PSA - Elliston Lafayette Waste Water Treatment Plant	Sewerage systems	VA0062219	001	0.07	390
Steel Dynamics	Steel works	VA0001589	005	0.06	1,090
Norfolk Southern Railway Co - Shaffers Crossing	Railroads, line-haul operating	VA0001597	002	0.009	390
WVWA Roanoke Regional Water Pollution Control Plant	Sewerage systems	VA0025020	001	37.35	340
Lower Roanoke (Staunton) River					
ITG Burlington Industries, LLC - Hurt Plant	Fabrics finishing	VA0001678	001	2.13	19,150
Old Dominion Pittsylvania Power Station	Electric Services	VA0083399	001	0.11	140
Altavista Town - Wastewater Treatment Plant	Sewerage systems	VA0020451	001	1.54	10,000
Old Dominion Altavista Power Station	Electric Services	VA0083402	001	0.117	140
Dan River, Inc. - Brookneal	Fabrics finishing	VA0001538	001	0.68	500
Brookneal Town - Staunton River Lagoon	Sewerage systems	VA0022241	001	0.04	140
Old Dominion Clover Power Station	Electric Services	VA0083097	001	0.75	190

VADEQ provided an inventory of MS4s and sites and facilities issued general permits for stormwater discharges in the Roanoke River basin. Such facilities are not subject to numerical criteria, but have responsibilities related to minimizing stormwater runoff and pollutant loads, and may be subject to monitoring requirements. Such areas are not represented explicitly in the model but are assigned PCB wasteload allocations in the TMDL. PCB loads for the areas are estimated as an area-weighted fraction of nonpoint source, land-use contributions with the PCB concentration represented by the appropriate potency factor.

Modeled land uses were overlain with GIS coverages of MS4s and sites covered by general stormwater permits to characterize the land use distributions of those areas. PCB loads for the permitted areas were calculated as the load generated by their respective land areas. Table G2-9 lists MS4s in the Roanoke River basin. Appendix C provides a list of sites and facilities covered by general stormwater permits. Loads from contaminated sites within the spatial extent of an MS4 or site permitted for stormwater are considered a component of the associated MS4 or general stormwater permit. Where a stormwater permit is located within an MS4, the load is assigned to the stormwater permit.

Table G2-9. MS4s in the Roanoke River watershed

MS4 permit holder	Permit number	Area (acres)
Roanoke County	VAR040022	28,907
City of Roanoke	VAR040004	23,577
Botetourt County	VAR040023	5,180
City of Salem	VAR040010	9,332
Town of Blacksburg	VAR040019	1,613

Attachment H

Endangered Species Information

France, Becky (DEQ)

From: Aschenbach, Ernie (DGIF)
Sent: Wednesday, January 22, 2014 2:24 PM
To: France, Becky (DEQ); 'Troy Andersen'; nhreview (DCR)
Cc: ProjectReview (DGIF); Cason, Gladys (DGIF)
Subject: ESSLog 31022; VPDES reissuance VA0025020 Western Virginia Water Authority Water Pollution Control Plant in Roanoke, VA

We have reviewed the application for VPDES reissuance for the above-referenced facility. The receiving water is the Roanoke River. The receiving water (2003) 7Q10 is 23 million gallons per day (MGD). The Design Flow of the facility is 55 MGD.

According to our records the Roanoke River is a designated Threatened and Endangered (T&E) species water for the federal Endangered state Endangered (FESE) Roanoke logperch and state Threatened (ST) orangefin madtom.

In general, when water is treated we typically recommend and support ultraviolet (UV) disinfection (rather than chlorination disinfection). We support the continued dechlorination of effluent after chlorine disinfection. Provided the applicant adheres to the effluent characteristics identified in the permit application, we do not anticipate the issuance of this permit to result in adverse impact to T&E species waters or their associated species.

This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend and support coordination with VDCR-DNH regarding the protection of these resources. We also recommend contacting the USFWS regarding all federally listed species.

Thank you for the opportunity to provide comments. Please call me if you have any questions.

Ernie Aschenbach
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
P.O. Box 11104
4010 West Broad Street
Richmond, VA 23230
Phone: (804) 367-2733
FAX: (804) 367-2427
Email: Ernie.Aschenbach@dgif.virginia.gov

France, Becky (DEQ)

From: nhreview (DCR)
Sent: Tuesday, August 27, 2013 6:55 PM
To: France, Becky (DEQ)
Cc: ProjectReview (DGIF); brett_hillman@fws.gov; susan_lingenfelser@fws.gov
Subject: VA002502, WWA WPCP
Attachments: 65114, DEQ VA002502, WWA WPCP.pdf

Ms. France,

Please find attached the DCR-DNH comments for the above referenced project. The comments are in pdf format and can be printed for your records. Also species rank information is available at http://www.dcr.virginia.gov/natural_heritage/help.shtml for your reference.

Thank you for the opportunity to comment on this project.

S. Rene' Hypes
Project Review Coordinator
Department of Conservation and Recreation
Division of Natural Heritage
600 East Main Street, 24th Floor
Richmond, Virginia 23219
804-371-2708 (phone)
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David A.

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

600 East Main Street, 24th Floor
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August 27, 2013

Becky France
DEQ – Southwest Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

Re: VA002502, WWA WPCP

Dear Ms. France:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Roanoke River – North and South Forks Stream Conservation Unit (SCU) is within the project site. SCUs identify stream reaches that contain aquatic natural heritage resources, including 2 miles upstream and 1 mile downstream of documented occurrences, and all tributaries within this reach. SCUs are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. The Roanoke River – North and South Forks SCU has been given a biodiversity significance ranking of B2, which represents a site of very high significance. The natural heritage resources of concern associated with this SCU are:

Noturus gilberti	Orangefin madtom	G2/S2/SOC/LT
Percina rex	Roanoke logperch	G1G2/S1S2/LE/LE
Allocapnia simmonsi	Spatulate snowfly	G3/S1S2/NL/NL

The Orangefin madtom is native to the Roanoke and James River systems of North Carolina and Virginia (NatureServe, 2009). The Orangefin madtom inhabits moderate to strong riffles and runs having little or no silt in moderate-gradient, intermontane and upper Piedmont streams. This species is an intersticine dweller, found in or near cavities formed by rubble and boulders (Jenkins and Burkhead, 1993). Please note that this species is currently classified as a species of concern (not a legal designation) by the United States Fish and Wildlife Service (USFWS) and as threatened by the Virginia Department of Game and Inland Fisheries (VDGIF). Threats to the Orangefin madtom include channelization, siltation, various forms of chronic pollution, catastrophic chemical spills, impoundment, dewatering, and bait-seining

(NatureServe, 2009). Its low reproductive rate and short life span (Simonson 1997, Simonson and Neves 1992, Simonson 1987) exacerbate these threats (Burkhead and Jenkins 1991).

The Roanoke logperch is endemic to the Roanoke and Chowan River drainages in Virginia (Burkhead and Jenkins, 1991) and inhabits medium and large, warm and usually clear rivers with sandy to boulder spotted bottoms (NatureServe, 2009). Please note that this species is currently classified as endangered by the USFWS and the VDGIF. The Roanoke logperch is threatened by channelization, siltation, impoundment, pollution, and de-watering activities (Burkhead & Jenkins, 1991).

Spatulate snowfly is a stonefly documented in only two locations in Virginia. Stoneflies are generally medium-sized to small, somewhat flattened, soft-bodied, rather drab-colored insects found near streams or rocky lake shores (Borror, 1981). They are poor fliers and are seldom found far from water. Stonefly nymphs are often found under stones in streams but may occasionally be found anywhere in a stream where food is available (Borror, 1981). Stoneflies are highly sensitive to any practices that degrade the quality of its aquatic habitat.

In addition, Roanoke River 2 has been designated by the VDGIF as a "Threatened and Endangered Species Water" and is downstream of the project site. The species associated with this T & E Water are the Orangefin madtom and the Roanoke logperch.

To minimize impacts to aquatic resources, DCR recommends the use of uv/ozone to replace chlorination disinfection and utilization of new technologies as they become available to improve water quality. Due to the legal status of the Roanoke logperch and Orangefin madtom, DCR also recommends coordination with the USFWS and the VDGIF to ensure compliance with protected species legislation.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The VDGIF maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Gladys Cason (804-367-0909 or Gladys.Cason@dgif.virginia.gov). According to the information currently in our files, Glade Creek and Tinker Creek, which have been designated by VDGIF as "Threatened and Endangered Species Waters" for the Roanoke logperch, are within 2 miles of the project area. Therefore, DCR recommends coordination with the USFWS and the VDGIF, Virginia's regulatory authority for the management and protection of this species to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

Should you have any questions or concerns, feel free to contact René Hypes at 804-371-2708. Thank you for the opportunity to comment on this project.

Sincerely,

René Hypes

S. René Hypes
Project Review Coordinator

CC: Brett Hillman, USFWS
Susan Lingenfelser, USFWS
Ernie Aschenbach, VDGIF

Literature Cited

Borror, D.J., D. M. De Long, and C. A. Triplehorn. 1981. An Introduction to the Study of Insects. Saunders College Publishing, Philadelphia.

Burkhead, N.M. and R.E. Jenkins. 1991. Roanoke logperch. In Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. p. 395-397.

Jenkins, R. E., and N. M. Burkhead. 1993. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: June 21, 2010).

Simonson, T. D. 1987. Distribution, ecology, and reproductive biology of the orangefin madtom (Noturus gilberti). M.S. Thesis, Virginia Polytechnic Institute & State University, Blacksburg.

Simonson, T. D. 1997. Orangefin madtom. Pages 15-16 in E. F. Menhinick and A. L. Braswell, editors. Endangered, threatened, and rare fauna of North Carolina. Part IV. A reevaluation of the freshwater fishes. Occasional Papers of the North Carolina Museum of Natural Sciences and the North Carolina Biological Survey No. 11.

Simonson, T. D., and R. J. Neves. 1992. Habitat suitability and reproductive traits of the orangefin madtom NOTURUS GILBERTI (Pisces: Ictaluridae). American Midland Naturalist 127:115-24.

France, Becky (DEQ)

From: France, Becky (DEQ)
Sent: Wednesday, February 19, 2014 12:14 PM
To: 'Hillman, Brett'
Subject: RE: WVWA WPCP - VA0025020

I understand that you have concerns that excess loading of chlorine may negatively impact any Roanoke logperch in the area. The facility utilizes chlorination as a means of disinfection followed by dechlorination. The actual limit for effluent total residual chlorine (TRC) is nondetect. The quantification level is given as 0.1 mg/L. Even though the limits are expressed in actual numerical terms, the target is "nondetect" for the procedure. DEQ does not specify the type of treatment needed but reviews applications and incorporates limits into permits which are protective of water quality. The permittee has a good compliance history with their effluent TRC limitations for outfall 001. It is believed that the effluent limitations will be protective to water quality.

I have reviewed your comments and recommendations to apply more stringent proposed EPA criteria for ammonia. DEQ used the current Virginia Water Standards adopted by the State Water Control Board and approved by EPA to determine VPDES effluent limitations that are protective of human health and the environment. These standards are updated on a regular basis (triennial review) to incorporate new information applicable to Virginia. DEQ acknowledges the research to support lower water quality criteria. The comments EPA received for the draft ammonia criteria are still under consideration. These criteria may not be final in Virginia for a few years and the exact numerical value of the proposed criteria may change in this process. The US Fish and Wildlife Service's concerns about the ammonia criteria may be addressed as part of the Water Quality Standards triennial review process. Following that regular review process, any adopted revisions to the Virginia Water Quality Standards regulations are then included in future permit actions.

From: Hillman, Brett [mailto:brett_hillman@fws.gov]
Sent: Wednesday, February 19, 2014 11:18 AM
To: France, Becky (DEQ)
Cc: Hypes, Rene (DCR); Aschenbach, Ernie (DGIF); Ewing, Amy (DGIF)
Subject: WVWA WPCP - VA0025020

Hi Becky,

Thanks again for taking the time to answer my questions. I reviewed this permit reissuance carefully [redacted] After looking over your answers and the materials you sent, we (the U.S. Fish and Wildlife Service) have two comments:

1) We recommend ultraviolet disinfection instead of chlorination disinfection for this facility. Excessive loading of chlorine is believed to have negatively impacted at least one Roanoke logperch population in Virginia (Burkhead and Jenkins 1991).

2) We recommend that the EPA 2013 Ammonia Criteria (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OW-2009-0921-0068) be used to calculate ammonia limits for this facility. These criteria are based on the most recent scientific data and are designed to be protective of all aquatic species. While these criteria may not yield limits that

differ from those in the draft permit, it is important to at least run the models.

Please feel free to respond to my comments or ask any questions you may have.

Best,
Brett

Reference:

Burkhead, N.M. and R.E. Jenkins. 1991. Fishes. IN: Virginia's Endangered Species, proceedings of a symposium. Karen Terwilliger (ed.). McDonald and Woodward Publishing Company, Blacksburg, VA. 672 pp.

Brett Hillman
Fish and Wildlife Biologist
U.S. Fish & Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

Phone: 804-693-6694 ext. 156
Fax: 804-693-9032
Email: brett_hillman@fws.gov

Attachment I

Instream Water Quality Data for Existing Baseline Antidegradation Calculations

- Upstream Roanoke River Dissolved Metals Data Summary (1994-1998)
- Upstream Ammonia Data (1998-2006) (4AROA202.20)
- Upstream Chloride Data (1996-2001) (4AROA202.20)
- Upstream Water Quality Lab Data Reports

Western Virginia Water Authority WPCP
VA0025020

Upstream Roanoke River Dissolved Metals Data (ug/L)

	3/24/94	4/12/94*	5/13/94	6/15/94	7/12/94	8/94	9/94	10/19/94	11/15/94	12/9/94	1/95	2/95	8/2/95	11/21/95	6/25/96	12/12/96	5/13/97	10/30/97	5/20/98
As	<1	~~<2~~	<2	2	<2	7	<2	<2	<2	<2	<2	<2	<5	<2	<5	<2	<2	<2	<2
Cd	0.17	~~6~~	0.3	<0.1	<0.1	<0.1	0.4	0.1	0.2	0.4	<0.1	0.1	0.1	<1	<0.5	<1	<1	<1	<1
Cr III	<7	~~50~~	1	1	<1	<1	<1	<1	<1	<1	<1	1.6	<1	6	<10	<5	<5	<5	<5
Cr VI	<10	~~<10~~	<10	<10	<50	<10	<10	<10	<1	<50	<10	<10	<10	<10	<10		<10		<10
Cu	<10	~~50~~	1	3	1	4	3	1	<1	2	<1	2.5	1	<10	<10	<30	<5	6	<30
Pb	<1	~~1~~	3	2	1	5	4	1	13	2	1.5	<1	<1	<1	<0.5	<1	<1	1	<1
Hg	<0.2	~~0.1~~	0.1	0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.4	<0.2
Ni	<12	~~92~~	<40	14	1	5	1	1	<10	<1	<1	4	1	<10	<5	<10	<40	<40	<40
Se	<2	~~3~~	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<5	<2	<2	<2	<2
Ag	<0.1	~~110~~	0.7	1.6	<0.5	0.6	2.8	2.3	11	1.8	1.1	<0.5	<0.5	<0.2	<2	<0.2	<0.2	<0.2	<0.2
Zn	14.8	~~29~~	33	<5	<5	11	15	<25	<10	0.4	<25	<10	<10	10	<10	<10	10	60	10

* Data for 4/12/94 not used due to extreme outliers

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge above WVWA WPCP outfall 001)

Ammonia as Nitrogen

Collection Date Time	(mg/L)	Com Code
1/21/1998 11:00	0.04	U
2/11/1998 7:15	0.04	U
3/9/1998 10:20	**0.04**	NULL
4/14/1998 10:15	0.04	U
5/26/1998 10:20	0.04	U
6/8/1998 10:00	0.04	U
7/14/1998 10:50	0.04	U
8/24/1998 10:15	0.04	U
9/23/1998 11:40	**0.04**	NULL
10/27/1998 10:15	0.04	U
11/9/1998 8:35	0.04	U
12/3/1998 10:20	0.04	U
1/5/1999 10:55	0.04	U
1/11/1999 11:30	0.04	U
2/2/1999 9:50	**0.07**	NULL
3/17/1999 10:10	0.04	U
4/14/1999 10:15	0.04	U
5/5/1999 9:00	0.04	U
6/9/1999 9:40	0.04	U
7/22/1999 9:30	**0.36**	NULL
8/11/1999 9:30	**0.05**	NULL
9/20/1999 9:00	0.04	U
11/17/1999 9:30	0.04	U
12/15/1999 10:25	0.04	U
1/25/2000 9:30	0.04	U
2/15/2000 9:45	0.04	U
3/1/2000 10:25	0.04	U
4/12/2000 9:10	0.04	U
5/18/2000 10:05	**0.04**	NULL
6/13/2000 10:40	0.04	U
7/18/2000 12:30	0.04	U
8/9/2000 13:00	0.04	U
9/19/2000 12:00	**0.06**	NULL
10/11/2000 12:00	0.04	U
11/9/2000 11:00	0.04	U
12/13/2000 11:00	0.04	U
1/18/2001 13:30	0.04	U
2/15/2001 11:00	0.04	U
3/19/2001 11:30	0.04	U
4/2/2001 12:00	0.04	U
5/1/2001 11:00	0.04	U
6/4/2001 13:00	0.04	U
7/24/2001 9:00	0.04	U
8/7/2001 9:00	0.04	U
9/10/2001 10:00	**0.04**	NULL

U= not quantifiable

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge above WVWA WPCP outfall 001)

Ammonia as Nitrogen

Collection Date Time	(mg/L)	Com Code
10/10/2001 10:30	0.04	U
11/19/2001 9:30	0.04	U
12/19/2001 9:00	0.04	U
1/14/2002 10:30	0.04	U
2/4/2002 9:00	0.04	U
3/11/2002 10:00	0.04	U
4/1/2002 10:00	0.04	U
5/2/2002 15:30	**0.06**	NULL
6/4/2002 8:15	**0.04**	NULL
7/30/2002 8:45	**0.04**	NULL
8/27/2002 8:50	**0.05**	NULL
9/25/2002 9:00	0.04	U
10/23/2002 9:15	0.04	U
11/19/2002 9:20	0.04	U
12/16/2002 9:30	0.04	U
1/14/2003 9:20	0.04	U
2/11/2003 8:30	0.04	U
3/4/2003 10:00	0.04	U
4/3/2003 10:00	0.04	U
5/5/2003 10:00	0.04	U
6/19/2003 10:00	0.04	U
7/13/2005 12:30	0.04	U
9/19/2005 11:30	0.04	U
11/28/2005 11:30	0.04	U
1/10/2006 12:00	0.04	U
3/8/2006 11:30	0.04	U
5/4/2006 11:00	0.04	U
7/17/2006 12:00	0.04	U
9/12/2006 10:00	0.04	U
11/7/2006 13:00	0.04	U

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge above WVWA WWTP outfall 001)

Chloride, Total

Collection Date Time	mg/L
1/17/1996 10:05	14.4
2/14/1996 10:00	9.8
3/6/1996 10:00	9.5
4/9/1996 11:40	7.9
5/6/1996 11:30	7.8
6/6/1996 10:30	8.4
7/29/1996 10:50	9.2
8/27/1996 10:45	8.1
9/25/1996 7:45	9.3
10/23/1996 10:10	9.3
11/6/1996 12:20	9.2
12/12/1996 12:15	6.9
1/13/1997 11:35	10.7
2/5/1997 10:55	7.7
3/18/1997 8:50	8.4
4/14/1997 11:00	7.2
5/20/1997 10:05	7.6
6/16/1997 10:20	13.4
7/14/1997 11:10	9
8/18/1997 11:15	9
9/16/1997 10:00	9.5
10/22/1997 10:30	9.1
11/6/1997 8:45	9.9
12/4/1997 9:45	10
1/21/1998 11:00	9.2
2/11/1998 7:15	8.5
3/9/1998 10:20	7.5
4/14/1998 10:15	6.5
5/26/1998 10:20	5.6
6/8/1998 10:00	7.3
7/14/1998 10:50	9.6
8/24/1998 10:15	10.1
9/23/1998 11:40	10.2
10/27/1998 10:15	9.6
11/9/1998 8:35	11.2
12/3/1998 10:20	10.3
1/5/1999 10:55	12.4
1/11/1999 11:30	24.5
2/2/1999 9:50	37.9
3/17/1999 10:10	13.4
4/14/1999 10:15	7.9
5/5/1999 9:00	8.85
6/9/1999 9:40	14
7/22/1999 9:30	7.1
8/11/1999 9:30	14.1
9/20/1999 9:00	10.6

VAW-L04R Roanoke River
4AROA202.20 (14th Street Bridge above WVWA WWTP outfall 001)

Chloride, Total

Collection Date Time	mg/L
11/17/1999 9:30	10.9
12/15/1999 10:25	7.9
1/25/2000 9:30	17
2/15/2000 9:45	11.7
3/1/2000 10:25	11.7
4/12/2000 9:10	9.4
5/18/2000 10:05	13.3
6/13/2000 10:40	13.5
7/18/2000 12:30	11.8
8/9/2000 13:00	15.6
9/19/2000 12:00	6.9
10/11/2000 12:00	11.2
11/9/2000 11:00	11.7
12/13/2000 11:00	11.4
1/18/2001 13:30	12
2/15/2001 11:00	11.4
3/19/2001 11:30	12.1
4/2/2001 12:00	7.7
5/1/2001 11:00	10.9
6/4/2001 13:00	9.9

Mean 10.7 mg/L

Water Chemistry Inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division

Laboratories and Consultants

Date Reported: June 2, 1998

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, SE
Roanoke VA 24014

Sample Code: 98-1894
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 20, 1998
Time Collected: 1335
Collected By: Client
Collection Method: Composite
Sample Description: Total Dissolved Metals
Roanoke River bridge

Date Received: May 20, 1998
Time Received: 1435
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 98-1894

Parameter	Result	MDL	Method	Date	Analyst
Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/25/98	RMP
Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/28/98	RMP
Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/22/98	RMP
Copper	<0.03 mg/L	0.03 mg/L	SM 3111B	05/28/98	RMP
Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/25/98	RMP
Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/26/98	RMP
Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/28/98	RMP
Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	06/01/98	RMP
Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/22/98	RMP
Zinc	0.01 mg/L	0.01 mg/L	SM 3111B	05/27/98	RMP
Hardness	229.8 mg$CaCO_3$/L	4.6 mg$CaCO_3$/L	SM 2340C	05/27/98	BRV
	13.44 gr$CaCO_3$/gal	0.27 gr$CaCO_3$/gal	WCI	05/27/98	BRV

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423

Water Chemistry, Inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Date Reported: June 12, 1998

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, SE
Roanoke VA 24014

Sample Code: 98-1890
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 20, 1998
Time Collected: 0855
Collected By: Client
Collection Method: Grab
Sample Description: Roanoke River

Date Received: May 20, 1998
Time Received: 1240
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 98-1890

Parameter	Result	MDL	Method	Date	Analyst
Hexavalent Chromium	<0.01 mg/L	0.01 mg/L	SM 3111B	05/21/98	RMP
Cyanide	<0.02 mg/L	0.02 mg/L	EPA 335.2	05/29/98	KLC

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No; Virginia #0423

Water Chemistry Inc
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Date Reported: December 3, 1997
Sample Code: 49694
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: October 30, 1997
Time Collected: 0845
Collected By: M. Sensabaugh
Collection Method: Composite
Sample Description: Roanoke River

Date Received: October 30, 1997
Time Received: 1430
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes: Reissued to correct results for dissolved and total barium.

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 49694

Parameter	Result	MDL	Method	Date	Analyst
Dissolved Metals:					
Dissolved Arsenic	<0.002 mg/L	0.002 mg/L	EPA 206	11/12/97	R. PHILLIPS
Dissolved Cadmium	<0.001 mg/L	0.001 mg/L	EPA 213.2	11/05/97	R. PHILLIPS
Dissolved Chromium	<0.005 mg/L	0.005 mg/L	EPA 218.2	11/11/97	R. PHILLIPS
Dissolved Copper	0.006 mg/L	0.005 mg/L	EPA 220.2	11/13/97	R. PHILLIPS
Dissolved Lead	0.001 mg/L	0.001 mg/L	EPA 239.2	11/07/97	R. PHILLIPS
Dissolved Mercury	0.0004 mg/L	0.0002 mg/L	EPA 245.1	11/10/97	R. PHILLIPS
Dissolved Nickel	<0.04 mg/L	0.04 mg/L	EPA 249.2	11/04/97	R. PHILLIPS
Dissolved Selenium	<0.002 mg/L	0.002 mg/L	EPA 270.2	11/12/97	R. PHILLIPS
Dissolved Silver	<0.0002 mg/L	0.0002 mg/L	EPA 272.2	11/06/97	R. PHILLIPS
Dissolved Zinc	0.06 mg/L	0.01 mg/L	EPA 289.1	11/05/97	R. PHILLIPS
Dissolved Barium	0.019 mg/L	0.010 mg/L	EPA 208.2	11/12/97	R. PHILLIPS
Hardness	140.6 mg$CaCO_3$/L	3.8 mg$CaCO_3$/L	SM 2340C	11/03/97	J. PORTER
	8.22 gr$CaCO_3$/gal	0.22 gr$CaCO_3$/gal	WCI	11/03/97	J. PORTER

water chemistry inc
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Date Reported: December 3, 1997
Sample Code: 49694 pg.2
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: October 30, 1997
Time Collected: 0845
Collected By: M. Sensabaugh
Collection Method: Composite
Sample Description: Roanoke River

Date Received: October 30, 1997
Time Received: 1430
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 49694 pg.2

Parameter	Result	MDL	Method	Date	Analyst
Total Metals:					
Total Arsenic	<0.002 mg/L	0.002 mg/L	EPA 206	11/12/97	R. PHILLIPS
Total Cadmium	<0.001 mg/L	0.001 mg/L	EPA 213.2	11/05/97	R. PHILLIPS
Total Chromium	<0.005 mg/L	0.005 mg/L	EPA 218.2	11/11/97	R. PHILLIPS
Total Copper	0.008 mg/L	0.005 mg/L	EPA 220.2	11/13/97	R. PHILLIPS
Total Lead	0.002 mg/L	0.001 mg/L	EPA 239.2	11/07/97	R. PHILLIPS
Total Mercury	0.0012 mg/L	0.0002 mg/L	EPA 245.1	11/10/97	R. PHILLIPS
Total Nickel	<0.04 mg/L	0.04 mg/L	EPA 249.2	11/04/97	R. PHILLIPS
Total Selenium	<0.002 mg/L	0.002 mg/L	EPA 270.2	11/12/97	R. PHILLIPS
Total Silver	0.0010 mg/L	0.0002 mg/L	EPA 272.2	11/06/97	R. PHILLIPS
Total Zinc	0.05 mg/L	0.01 mg/L	EPA 289.1	11/05/97	R. PHILLIPS
Total Barium	0.023 mg/L	0.010 mg/L	EPA 208.2	11/12/97	R. PHILLIPS
Hardness	186.2 mg$CaCO_3$/L	3.8 mg$CaCO_3$/L	SM 2340C	11/03/97	J. PORTER
	10.89 gr$CaCO_3$/gal	0.22 gr$CaCO_3$/gal	WCI	11/03/97	J. PORTER

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Date Reported: May 23, 1997

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Sample Code: 46721
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0900
Collected By: M. Sensabuagh
Collection Method: Composite
Sample Description: Roanoke River

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46721

Parameter	Result	MDL	Method	Date	Analyst
Total Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Total Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/16/97	C. EASTER
Total Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Total Copper	<0.005 mg/L	0.005 mg/L	SM 3113B	05/16/97	C. EASTER
Total Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/15/97	C. EASTER
Total Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/21/97	M. HILGER
Total Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/15/97	C. EASTER
Total Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	05/22/97	R. PHILLIPS
Total Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/19/97	R. PHILLIPS
Total Zinc	0.04 mg/L	0.01 mg/L	SM 3111B	05/15/97	C. EASTER
Hardness	160 mg$CaCO_3$/L	4.0 mg$CaCO_3$/L	SM 2340C	05/19/97	J. MORRIS
	9.36 gr$CaCO_3$/gal	0.23 gr$CaCO_3$/gal	WCI	05/19/97	J. MORRIS

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

D. C. Cline

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Date Reported: May 23, 1997

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Sample Code: 46721 p.2
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0900
Collected By: M. Sensabuagh
Collection Method: Grab
Sample Description: Roanoke River

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46721 p.2

Parameter	Result	MDL	Method	Date	Analyst
Dissolved Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Dissolved Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/16/97	C. EASTER
Dissolved Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Dissolved Copper	<0.005 mg/L	0.005 mg/L	SM 3113B	05/16/97	C. EASTER
Dissolved Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/15/97	C. EASTER
Dissolved Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/21/97	M. HILGER
Dissolved Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/15/97	C. EASTER
Dissolved Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	05/22/97	R. PHILLIPS
Dissolved Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/19/97	R. PHILLIPS
Dissolved Zinc	0.01 mg/L	0.01 mg/L	SM 3111B	05/15/97	C. EASTER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

O. C. Crews

Environmental Engineering Consultants

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division

Laboratories and Consultants

Date Reported: May 23, 1997

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Sample Code: 46722
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0940
Collected By: M. Sensabuagh
Collection Method: Grab
Sample Description: Roanoke River

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46722

Parameter	Result	MDL	Method	Date	Analyst
Hexachromium	<0.01 mg/L	0.01 mg/L	EPA 218.4	05/14/97	C. EASTER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

W. C. Crews

Environmental Testing Consultants, Inc.

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division

Laboratories and Consultants

Date Reported: May 23, 1997

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Sample Code: 46723
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0940
Collected By: M. Sensabaugh
Collection Method: Grab
Sample Description: Roanoke River

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46723

Parameter	Result	MDL	Method	Date	Analyst
Cyanide	<0.02 mg/L	0.02 mg/L	EPA 335.2	05/15/97	M. HILGER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

for Environmental Testing, Consultants

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division
Laboratories and Consultants

Date Reported: June 2, 1998

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, SE
Roanoke VA 24014

Sample Code: 98-1893
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 20, 1998
Time Collected: 1335
Collected By: Client
Collection Method: Composite
Sample Description: Total Recoverable Metals
Roanoke River bridge

Project Name: Roanoke River
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Date Received: May 20, 1998
Time Received: 1435
Sample Type: Waste Water

Analytical Data and Quality Assurance Information

Sample Code: 98-1893

Parameter	Result	MDL	Method	Date	Analyst
Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/25/98	RMP
Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/28/98	RMP
Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/22/98	RMP
Copper	<0.03 mg/L	0.03 mg/L	SM 3111B	05/28/98	RMP
Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/25/98	RMP
Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/26/98	RMP
Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/28/98	RMP
Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	06/01/98	RMP
Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/22/98	RMP
Zinc	0.01 mg/L	0.01 mg/L	SM 3111B	05/27/98	RMP
Hardness	275.8 mg$CaCO_3$/L	4.6 mg$CaCO_3$/L	SM 2340C	05/27/98	BRV
	16.12 gr$CaCO_3$/gal	0.27 gr$CaCO_3$/gal	WCI	05/27/98	BRV

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423

Q BioChem, L.L.C.
Analysis, Research & Technology Development

A USEPA Contract Laboratory

DEQ-WCRO

DEC 1 0 1998

RECEIVED

Roanoke Regional Water Pollution Control
1402 Bennington St. S.E.
Roanoke, VA 24014
ATTN: Mr. Marty Sensabaugh

Re: Laboratory Analysis
Q BioChem Client No. 10384
Permit Required River/FAS

REPORT DATE/NUMBER: November 13, 1998 / 157

ANALYSIS FOR: Total and Dissolved Metals, Hardness, Cr+6

METHOD OF ANALYSIS: USEPA Methods 200.7, 235.1, 130.2; Standard Methods 18th Edition 3500Cr

SAMPLE ANALYSIS DATA

CLIENT ID: RKE. RIVER
MATRIX: Water
COLLECTION DATE: 11/03/98
OTHER ID: NPDES
DESCRIPTION: PERMIT REQUIRED RIVER/FAS

LAB ID: 234853
COLLECTED BY: CLIENT
DATE RECEIVED: 11/04/98
TIME COLLECTED: 1115

METALS/ELEMENTS RESULTS:

Arsenic — < 5.00 ug/l
↳>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Arsenic, Dissolved — < 5.00 ug/l
↳>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Cadmium — < 1.00 ug/l
↳>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=1.00 ug/l

Cadmium, Dissolved — < 1.00 ug/l
↳>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=1.00 ug/l

REPORT CONTINUED ON NEXT PAGE

1401 Municipal Road, Roanoke, VA 24012-1309 • 800-897-0297
540-265-7211 (voice) • 540-563-4866 (fax)
qbiochem@roanoke.infi.net (e-mail)

SAMPLE ANALYSIS DATA

CLIENT ID: RKE. RIVER • LAB ID: 234853 (continued)

Copper — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Copper, Dissolved — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Lead — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Lead, Dissolved — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Mercury — **< 0.20 ug/l**
>Analysis Date: 11/06/98 Time: 10:13 by: LBH Run ID: 110698CV
>Method: CVAAS, USEPA 245.1; Quantitation Limit=0.20 ug/l

Mercury, Dissolved — **< 0.20 ug/l**
>Analysis Date: 11/06/98 Time: 10:21 by: LBH Run ID: 110698CV
>Method: CVAAS, USEPA 245.1; Quantitation Limit=0.20 ug/l

Nickel — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Nickel, Dissolved — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Silver — **< 2.00 ug/l**
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=2.00 ug/l

Silver, Dissolved — **< 2.00 ug/l**
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=2.00 ug/l

Trivalent Chromium — **< 5.00 ug/l**
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

REPORT CONTINUED ON NEXT PAGE

SAMPLE ANALYSIS DATA

CLIENT ID: RKE. RIVER ▪ LAB ID: 234853 (continued)

Trivalent Chromium, Dissolved ——— < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Zinc ——— 8.17 ug/l
>Analysis Date: 11/10/98 Time: 09:49 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Zinc, Dissolved ——— 6.77 ug/l
>Analysis Date: 11/10/98 Time: 10:07 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

ROUTINE LABORATORY RESULTS:

Hardness ——— 229 mg/l
>Analysis Date: 11/11/98 Time: 14:38 by: LAF Run ID: HRD111198
>Method: Titrimetric, USEPA 130.2; Quantitation Limit=1 mg/l

Hexavalent Chromium, Dissolved ——— < 0.010 mg/l
>Analysis Date: 11/05/98 Time: 11:12 by: LAF Run ID: CR6110598
>Method: Colorimetric, SM 3500Cr D; Quantitation Limit=0.010 mg/l

Hexavalent Chromium, Total ——— < 0.010 mg/l
>Analysis Date: 11/05/98 Time: 11:10 by: LAF Run ID: CR6110598
>Method: Colorimetric, SM 3500Cr D; Quantitation Limit=0.010 mg/l

CLIENT ID: FAS
MATRIX: Water
COLLECTION DATE: 11/03/98
OTHER ID: NPDES
DESCRIPTION: PERMIT REQUIRED RIVER/FAS

LAB ID: 234854
COLLECTED BY: CLIENT
DATE RECEIVED: 11/04/98
TIME COLLECTED: 1000

METALS/ELEMENTS RESULTS:

Arsenic ——— < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Arsenic, Dissolved ——— < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

REPORT CONTINUED ON NEXT PAGE

SAMPLE ANALYSIS DATA

CLIENT ID: FAS ▪ LAB ID: 234854 (continued)

Cadmium — < 1.00 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=1.00 ug/l

Cadmium, Dissolved — < 1.00 ug/l
>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=1.00 ug/l

Copper — 5.62 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Copper, Dissolved — < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Lead — < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Lead, Dissolved — < 5.00 ug/l
>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Mercury, Dissolved — < 0.20 ug/l
>Analysis Date: 11/06/98 Time: 10:26 by: LBH Run ID: 110698CV
>Method: CVAAS, USEPA 245.1; Quantitation Limit=0.20 ug/l

Mercury, Total — < 0.20 ug/l
>Analysis Date: 11/06/98 Time: 10:20 by: LBH Run ID: 110698CV
>Method: CVAAS, USEPA 245.1; Quantitation Limit=0.20 ug/l

Nickel — 6.44 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Nickel, Dissolved — 5.05 ug/l
>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Silver — < 2.00 ug/l
>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
>Method: ICP, USEPA 200.7; Quantitation Limit=2.00 ug/l

REPORT CONTINUED ON NEXT PAGE

SAMPLE ANALYSIS DATA

CLIENT ID: FAS ▪ LAB ID: 234854 (continued)

Silver, Dissolved ——— **< 2.00 ug/l**
↳>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=2.00 ug/l

Trivalent Chromium ——— **< 5.00 ug/l**
↳>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Trivalent Chromium, Dissolved ——— **< 5.00 ug/l**
↳>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Zinc ——— **36.8 ug/l**
↳>Analysis Date: 11/10/98 Time: 10:28 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

Zinc, Dissolved ——— **34.4 ug/l**
↳>Analysis Date: 11/10/98 Time: 10:31 by: JW Run ID: 111098TR
↳>Method: ICP, USEPA 200.7; Quantitation Limit=5.00 ug/l

ROUTINE LABORATORY RESULTS:

Hardness ——— **158 mg/l**
↳>Analysis Date: 11/11/98 Time: 14:42 by: LAF Run ID: HRD111198
↳>Method: Titrimetric, USEPA 130.2; Quantitation Limit=1 mg/l

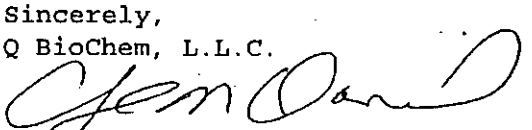
Hexavalent Chromium, Dissolved ——— **< 0.010 mg/l**
↳>Analysis Date: 11/05/98 Time: 11:16 by: LAF Run ID: CR6110598
↳>Method: Colorimetric, SM 3500Cr D; Quantitation Limit=0.010 mg/l

Hexavalent Chromium, Total ——— **< 0.010 mg/l**
↳>Analysis Date: 11/05/98 Time: 11:14 by: LAF Run ID: CR6110598
↳>Method: Colorimetric, SM 3500Cr D; Quantitation Limit=0.010 mg/l

Quality Assurance performed on the above data is presented on the following page(s).

If we may be of further assistance, please contact us at any time.

Sincerely,
Q BioChem, L.L.C.



Cheryl M. Daniel, Laboratory Manager

Attachment J

Effluent Water Quality Data for Existing Baseline Antidegradation Calculations

- Effluent Dissolved Metals Data Summary (1994-1997)
- Effluent Chloride Data Summary (1997-1998)
- Effluent Water Quality Lab Data Reports

Western Virginia Water Authority WPCP
VA0025020

Effluent Dissolved Metals Data (µg/L)

	3/24/94	4/12/94*	5/13/94	6/15/94	7/12/94	8/94	9/94	10/19/94	11/15/94	12/9/94	1/95	2/95	8/2/95	11/21/95	6/25/96	12/12/96	5/13/97	10/30/97	5/20/98	** 5/17/94	** 4/3/95	** 5/13/97
As	<1	~~<2~~	<2	3	<2	11	<2	<2	<2	<2	2	<2	<5	<2	<5	<2	<2	<2	<2	<1	<2	<5
Cd	0.14	~~<5~~	0.1	0.2	0.2	<0.1	0.6	0.2	1	0.5	0.2	0.1	0.6	<1	<0.5	2	<1	<1	<1	0.1	<10	0.7
CN										<5				90			<20		<20	<20	<20	<20	
Cr III	<7	~~50~~	2	3	<1	3	<1	<1	<1	1	3.6	1.6	<1	<5	<10	<5	<5	<5	<5	3	<10	<10
Cr VI	<10	~~<10~~	<10	<10	<50	<10	<10	<10	<1	<50	<10	<10	<10	<10	<10	800	<10	<10	<10	11	<10	<10
Cu	<10	~~50~~	2	3	1	4	8	8	<1	5	8.1	2.5	5	<10	<10	<30	<5	<5	<30	3	<10	<10
Pb	1.4	~~2~~	1	3	1	3	5	4	4	2	7.8	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	1.1
Hg	<0.2	~~0.4~~	0.1	0.2	<0.1	0.2	0.3	<0.1	<0.1	0.3	<1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2
Ni	<12	~~93~~	<40	18	5	6	11	9	<10	5	3	4	9	10	5.2	<10	<40	<40	<40	4	<20	52
Se	<2	~~6~~	7	5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<5	<2	<2	<2	<2	<1	2	7
Ag	<0.1	~~104~~	1.2	2.2	<0.5	0.6	4.2	3.1	5.4	3	1.5	<0.5	<0.5	<0.2	<2	<0.2	<0.2	<0.2	<0.2	0.4	10	<2
Zn	47	~~53~~	38	31	26	17	50	48	30	1.4	39	<10	<10	20	19.8	40	40	20	10	20	<10	56.6

* Data for 4/12/94 not used due to extreme outliers
** toxicity testing data

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Environmental Services Division
Laboratories and Consultants

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Date Reported: May 23, 1997
Sample Code: 46718 p.2
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0800
Collected By: M. Sensabuagh
Collection Method: Composite
Sample Description: FAS

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: WPCP FAS
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46718 p.2

Parameter	Result	MDL	Method	Date	Analyst
Dissolved Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Dissolved Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/16/97	C. EASTER
Dissolved Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Dissolved Copper	<0.005 mg/L	0.005 mg/L	SM 3113B	05/16/97	C. EASTER
Dissolved Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/15/97	C. EASTER
Dissolved Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/21/97	M. HILGER
Dissolved Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/15/97	C. EASTER
Dissolved Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	05/22/97	R. PHILLIPS
Dissolved Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/19/97	R. PHILLIPS
Dissolved Zinc	0.04 mg/L	0.01 mg/L	SM 3111B	05/15/97	C. EASTER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

D. C. Crews

Water Chemistry inc.
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Phone (540) 343-3618 • Fax (540) 342-2054

Environmental Services Division

Laboratories and Consultants

Date Reported: May 23, 1997
Sample Code: 46718
Client Code: 1018
Prepared By: T. Rakes

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0800
Collected By: M. Sensabuagh
Collection Method: Composite
Sample Description: FAS

Project Name: WPCP FAS
Analytical Notes:

DEQ-WCRO
JUN 13 1997
RECEIVED

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46718

Parameter	Result	MDL	Method	Date	Analyst
Total Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Total Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	05/16/97	C. EASTER
Total Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	05/20/97	R. PHILLIPS
Total Copper	<0.005 mg/L	0.005 mg/L	SM 3113B	05/16/97	C. EASTER
Total Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	05/15/97	C. EASTER
Total Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/21/97	M. HILGER
Total Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	05/15/97	C. EASTER
Total Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	05/22/97	R. PHILLIPS
Total Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	05/19/97	R. PHILLIPS
Total Zinc	0.04 mg/L	0.01 mg/L	SM 3111B	05/15/97	C. EASTER
Hardness	152 mg$CaCO_3$/L	4.0 mg$CaCO_3$/L	SM 2340C	05/19/97	J. MORRIS
	8.89 gr$CaCO_3$/gal	0.23 gr$CaCO_3$/gal	WCI	05/19/97	J. MORRIS

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

W. C. Cox

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3404 Aerial Way Drive • Roanoke, VA 24018
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Environmental Services Division
Laboratories and Consultants

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Date Reported: May 23, 1997
Sample Code: 46719
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0935
Collected By: M. Sensabuagh
Collection Method: Grab
Sample Description: FAS

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: WPCP FAS
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46719

Parameter	Result	MDL	Method	Date	Analyst
Hexachromium	<0.01 mg/L	0.01 mg/L	EPA 218.4	05/14/97	C. EASTER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

D. C. Cox

Environmental Testing, Engineering

Water Chemistry inc.
3404 Aerial Way Drive • Roanoke, VA 24018
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Environmental Services Division
Laboratories and Consultants

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, S.E.
Roanoke VA 24014-2697

Date Reported: May 23, 1997
Sample Code: 46720
Client Code: 1018
Prepared By: T. Rakes

Chain of Custody Information

Date Collected: May 13, 1997
Time Collected: 0935
Collected By: M. Sensabaugh
Collection Method: Grab
Sample Description: FAS

Date Received: May 13, 1997
Time Received: 1120
Sample Type: Waste Water

Project Name: WPCP FAS
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 46720

Parameter	Result	MDL	Method	Date	Analyst
Cyanide	<0.02 mg/L	0.02 mg/L	EPA 335.2	05/15/97	M. HILGER

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423 Maryland #183

W. C. Crews

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ORIGINAL

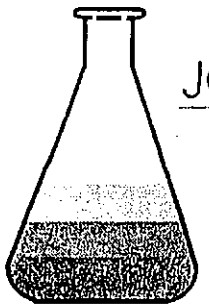
FINAL REPORT OF ANALYSES

City of Roanoke
1402 Bennington Street SE
Roanoke, VA 24014-
Attn: Chris S. Karageorge

REPORT DATE: 06/17/97

SAMPLE NUMBER- 21945 SAMPLE ID- F.A.S. OUTFALL 001 SAMPLE MATRIX- WW
DATE SAMPLED- 05/13/97 LOCATION- Outfall 001 TIME SAMPLED- 0700
DATE RECEIVED- 05/15/97 SAMPLER- CK RECEIVED BY- TLB
TIME RECEIVED- 1200 DELIVERED BY- UPS

ANALYSIS	METHOD	SAMPLE PREP DATE	BY	ANALYSIS DATE	BY	RESULT	UNITS	DET. LIMIT
Chlorine Residual				05/16/97	CSF	0.02	mg/L	0.01
CHLORIDE	EPA 325.3			05/20/97	SAH	72	mg/L	1.0
CYANIDE,TOTAL	EPA 335.2			06/12/97	CSF	<0.006	mg/L	0.006
HARDNESS AS CACO3	CALC.	05/19/97	SAH	05/21/97	RPA	137	mg/L CaCo3	
PH,LAB	EPA150.1			05/16/97	CSF	6.93	std units	
TOTAL DISS.SOLIDS	EPA160.1			05/19/97	DAM	321	mg/L	1
SULFIDE	EPA376.1			05/19/97	CSF	<0.1	mg/L	0.1
ORGANOCHLORINE PESTICIDE & PCB	EPA 608	04/24/97	BB	06/03/97	LOA			
ALDRIN	EPA 608					<0.075	ug/L	0.075
ALPHA BHC	EPA 608					<0.075	ug/L	0.075
BETA-BHC	EPA 608					<0.075	ug/L	0.075
DELTA-BHC	EPA 608					<0.075	ug/L	0.075
GAMMA-BHC	EPA 608					<0.025	ug/L	0.025
CHLORDANE	EPA 608					<0.4	ug/L	0.4
4,4'-DDD	EPA 608					<1.0	ug/L	1.0
4,4'-DDE	EPA 608					<1.0	ug/L	1.0
4,4'-DDT	EPA 608					<1.0	ug/L	1.0
DIELDRIN	EPA 608					<0.025	ug/L	0.025
ENDOSULFAN I	EPA 608					<0.05	ug/L	0.05
ENDOSULFAN II	EPA 608					<0.05	ug/L	0.05
ENDOSULFAN SULFATE	EPA 608					<0.05	ug/L	0.05



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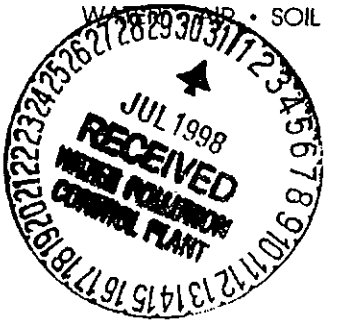

FINAL REPORT OF ANALYSES

City of Roanoke
1402 Bennington Street SE
Roanoke, VA 24014-
Attn: Biological Mon. Inc.

REPORT DATE: 06/17/98

SAMPLE NUMBER- 37944 SAMPLE ID- CITY OF ROANOKEFAS-001 COMP. SAMPLE MATRIX- WA
DATE SAMPLED- 05/20/98 LOCATION- Outfall 001 TIME SAMPLED- 1430
DATE RECEIVED- 05/21/98 SAMPLER- CK RECEIVED BY- TLB
TIME RECEIVED- 1000 DELIVERED BY- FED EX

ANALYSIS	METHOD	SAMPLE PREP DATE	BY	ANALYSIS DATE	BY	RESULT	UNITS	DET. LIMIT
Chlorine Residual				05/28/98	JLA	<.01	mg/L	.01
CHLORIDE	EPA 325.3			05/22/98	SAH	70	mg/L	1.0
CYANIDE,TOTAL	EPA 335.2			05/22/98	CSF	<0.003	mg/L	0.003
HARDNESS AS CACO3	CALC.	06/01/98	SAH	06/09/98	RPA	148	mg/L CaCo3	
TOTAL DISS.SOLIDS	EPA160.1			05/27/98	JLS	329	mg/L	1.0
ORGANOCHLORINE PESTICIDE & PCB	EPA 608	06/01/98	WRH	06/01/98	LOA			
ALDRIN	EPA 608					< 0.075	ug/L	0.075
ALPHA BHC	EPA 608					< 0.075	ug/L	0.075
BETA-BHC	EPA 608					< 0.075	ug/L	0.075
DELTA-BHC	EPA 608					< 0.075	ug/L	0.075
GAMMA-BHC	EPA 608					< 0.025	ug/L	0.025
CHLORDANE	EPA 608					< 0.4	ug/L	0.4
4,4'-DDD	EPA 608					< 1.0	ug/L	1.0
4,4'-DDE	EPA 608					< 1.0	ug/L	1.0
4,4'-DDT	EPA 608					< 1.0	ug/L	1.0
DIELDRIN	EPA 608					< 0.025	ug/L	0.025
ENDOSULFAN I	EPA 608					< 0.05	ug/L	0.05
ENDOSULFAN II	EPA 608					< 0.05	ug/L	0.05
ENDOSULFAN SULFATE	EPA 608					< 0.05	ug/L	0.05
ENDRIN	EPA 608					< 0.05	ug/L	0.05
ENDRIN ALDEHYDE	EPA 608					< 0.05	ug/L	0.05

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Environmental Services Division
Laboratories and Consultants

Date Reported: June 12, 1998
Sample Code: 98-1889
Prepared By: T. Rakes

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, SE
Roanoke VA 24014

Chain of Custody Information

Date Collected: May 20, 1998
Time Collected: 0905
Collected By: Client
Collection Method: Grab
Sample Description: FAS

Date Received: May 20, 1998
Time Received: 1240
Sample Type: Waste Water

Project Name: FAS
Analytical Notes:

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 98-1889

Parameter	Result	MDL	Method	Date	Analyst
Hexavalent Chromium	<0.01 mg/L	0.01 mg/L	SM 3111B	05/21/98	RMP
Cyanide	<0.02 mg/L	0.02 mg/L	EPA 335.2	05/29/98	KLC

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No: Virginia #0423

JTH # K1848
9-10-98 orig Ci

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Environmental Services Division
Laboratories and Consultants

Date Reported: June 12, 1998
Sample Code: 98-1888
Prepared By: T. Rakes

RECEIVED JUL 10 DEQ-WCRO

Roanoke Regional Water Pollution Control Plant
Attention: Marty Sensabaugh
1402 Bennington Street, SE
Roanoke VA 24014

Chain of Custody Information

Date Collected:	May 20, 1998	**Date Received:**	May 20, 1998
Time Collected:	0700	**Time Received:**	1240
Collected By:	Client	**Sample Type:**	Waste Water
Collection Method:	Composite		
Sample Description:	Total Recoverable Metals FAS		
Project Name:	FAS		
Analytical Notes:			

cc: TB Permit

Project Notes: MDL=Minimum Detection Level

Analytical Data and Quality Assurance Information

Sample Code: 98-1888

Parameter	Result	MDL	Method	Date	Analyst
Arsenic	<0.002 mg/L	0.002 mg/L	SM 3113B	06/12/98	RMP
Cadmium	<0.001 mg/L	0.001 mg/L	SM 3113B	06/03/98	RMP
Chromium	<0.005 mg/L	0.005 mg/L	SM 3113B	06/03/98	RMP
Copper	<0.03 mg/L	0.03 mg/L	SM 3111B	06/05/98	RMP
Lead	<0.001 mg/L	0.001 mg/L	SM 3113B	06/03/98	RMP
Mercury	<0.0002 mg/L	0.0002 mg/L	SM 3112B	05/20/98	RMP
Nickel	<0.04 mg/L	0.04 mg/L	SM 3111B	06/09/98	RMP
Selenium	<0.002 mg/L	0.002 mg/L	SM 3113B	06/12/98	RMP
Silver	<0.0002 mg/L	0.0002 mg/L	SM 3113B	06/04/98	RMP
Zinc	0.02 mg/L	0.01 mg/L	SM 3111B	06/05/98	RMP
Hardness	410.2 mg$CaCO_3$/L	5.1 mg$CaCO_3$/L	SM 2340C	06/08/98	KLC
	24.0 gr$CaCO_3$/gal	0.3 gr$CaCO_3$/gal	WCI	06/08/98	KLC

Analytical data meet precision and accuracy criteria established by the U.S.E.P.A. for drinking water, waste water, and solid wastes. Exceptions are noted in the analytical notes section of the certificate of analysis. Handling, preservation and collection of samples are performed according to E.P.A. protocol and 40 CFR part 136 and amendments.

Laboratory Certification No; Virginia #0423

Attachment K

Existing Instream Conditions Determinations

- **Instream Expected Value Determinations (STATS Program)**
- **Effluent Expected Value Determinations (STATS Program)**
- **Background Roanoke River Water Quality Calculations (Prior to 55 MGD Facility Upgrade)**

10/23/2008 11:46:25 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = chloride (mg/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 2
Expected Value = 71
Variance = 1814.76
C.V. = 0.6
97th percentile daily values = 172.772
97th percentile 4 day average = 118.129
97th percentile 30 day average= 85.6297
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

70
72

10/27/2008 9:09:32 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved arsenic (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 3
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = .656565
Variance = .155188
C.V. = 0.6
97th percentile daily values = 1.59769
97th percentile 4 day average = 1.09238
97th percentile 30 day average= .791852
< Q.L. = 18
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

11
0
0
0
0
2
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
3

10/27/2008 9:06:45 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved cadmium (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = .352513
Variance = .259166
C.V. = 1.444154
97th percentile daily values = 1.61497
97th percentile 4 day average = .891829
97th percentile 30 day average= .515261
< Q.L. = 7
Model used = delta lognormal

No Limit is required for this material

The data are:

0.14
0.1
0.2
0.2
0
0.6
0.2
1
0.5
0.2
0.1
0.6
0
0
2
0
0
0
0.1
0
0.7

10/27/2008 9:22:20 AM

Facility = WVWA WPCP (35MGD) expected value
Chemical = cyanide (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 6
Expected Value = 3.43516
Variance = 4.24812
C.V. = 0.6
97th percentile daily values = 8.35918
97th percentile 4 day average = 5.71538
97th percentile 30 day average= 4.14298
< Q.L. = 5
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
90
0
0
0
0

10/27/2008 9:23:48 AM

Facility = WVWA WPCP (35MGD) expected value
Chemical = chromium III (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = .927748
Variance = .309858
C.V. = 0.6
97th percentile daily values = 2.25760
97th percentile 4 day average = 1.54357
97th percentile 30 day average= 1.11891
< Q.L. = 14
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
2
3
0
3
0
0
0
1
3.6
1.6
0
0
0
0
0
0
0
3
0
0

10/23/2008 10:31:37 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = chromium VI (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 20
Expected Value = .468400
Variance = .078983
C.V. = 0.6
97th percentile daily values = 1.13981
97th percentile 4 day average = .779320
97th percentile 30 day average= .564915
< Q.L. = 19
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0
0
0
0
0
0
0
0
0
0
0
0
0
11
0
0
0
0
0

10/27/2008 8:56:39 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved copper (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = 2.94101
Variance = 9.68443
C.V. = 1.058131
97th percentile daily values = 10.5329
97th percentile 4 day average = 5.68923
97th percentile 30 day average= 3.82451
< Q.L. = 10
Model used = delta lognormal

No Limit is required for this material

The data are:

0
2
3
1
4
8
8
0
5
8.1
2.5
5
0
0
0
0
0
3
0
0
0

10/27/2008 8:59:05 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved lead (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = 2.11472
Variance = 4.47837
C.V. = 1.000703
97th percentile daily values = 7.62507
97th percentile 4 day average = 4.02049
97th percentile 30 day average= 2.71552
< Q.L. = 11
Model used = delta lognormal

No Limit is required for this material

The data are:

1.4
0
3
1
3
5
4
4
2
7.8
0
0
0
0
0
0
0
0
0
0
1.1

10/23/2008 10:36:47 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved mercury (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = .078827
Variance = .002236
C.V. = 0.6
97th percentile daily values = .191819
97th percentile 4 day average = .131152
97th percentile 30 day average= .095069
< Q.L. = 16
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0.1
0.2
0
0.2
0.3
0
0
0.3
0
0
0
0
0
0
0
0
0
0
0
0
0

10/23/2008 10:40:01 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved nickel (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 2
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = 7.09557
Variance = 66.8058
C.V. = 1.151912
97th percentile daily values = 26.7811
97th percentile 4 day average = 14.8923
97th percentile 30 day average= 9.55035
< Q.L. = 8
Model used = delta lognormal

No Limit is required for this material

The data are:

0
0
18
5
6
11
9
0
5
3
4
9
10
5.2
0
0
0
0
4
0
52

10/23/2008 10:41:47 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved selenium (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 1
# samples/mo. = 2
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = .731296
Variance = .192526
C.V. = 0.6
97th percentile daily values = 1.77955
97th percentile 4 day average = 1.21672
97th percentile 30 day average= .881982
< Q.L. = 17
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0
7
5
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
2
7

10/27/2008 9:02:05 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved silver (ug/L)
Chronic averaging period = 4
WLAa = 50
WLAc = 50
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = 1.71602
Variance = 12.5662
C.V. = 2.065758
97th percentile daily values = 9.98093
97th percentile 4 day average = 4.69045
97th percentile 30 day average= 2.72243
< Q.L. = 11
Model used = delta lognormal

No Limit is required for this material

The data are:

0
1.2
2.2
0
0.6
4.2
3.1
5.4
3
1.5
0
0
0
0
0
0
0
0
0.4
10
0

10/27/2008 9:04:36 AM

Facility = WVWA WPCP (35 MGD) expected value
Chemical = dissolved zinc (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1.4
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 21
Expected Value = 30.9395
Variance = 1325.00
C.V. = 1.176506
97th percentile daily values = 124.008
97th percentile 4 day average = 74.3495
97th percentile 30 day average= 43.4403
< Q.L. = 3
Model used = delta lognormal

No Limit is required for this material

The data are:

47
38
31
26
17
50
48
30
1.4
39
0
0
20
19.8
40
40
20
10
20
0
56.6

10/28/2008 3:56:52 PM

Facility = Roanoke River expected value
Chemical = ammonia as N (mg/L)
Chronic averaging period = 30
WLAa = 200
WLAc = 200
Q.L. = 0.04
# samples/mo. = 12
# samples/wk. = 3

Summary of Statistics:

observations = 75
Expected Value = .044508
Variance = .000490
C.V. = 0.497725
97th percentile daily values = .098788
97th percentile 4 day average = .060625
97th percentile 30 day average= .047912
< Q.L. = 64
Model used = delta lognormal

No Limit is required for this material

The data are:

0.04
0.04
0.07
0.36
0.05
0.04
0.06
0.04
0.06
0.04
0.05
0
0
0
0
0
0
0
0
0
0
0
0

(ammonia) Roanoke River expected value

0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
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0
0
0
0
0
0
0
0

10/27/2008 9:31:57 AM

Facility = Roanoke River expected value
Chemical = dissolved arsenic (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .607860
Variance = .133017
C.V. = 0.6
97th percentile daily values = 1.47917
97th percentile 4 day average = 1.01135
97th percentile 30 day average= .733111
< Q.L. = 16
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0
2
0
7
0
0
0
0
0
0
0
0
0
0
0
0
0
0

10/27/2008 10:37:49 AM

Facility = Roanoke River expected value
Chemical = dissolved cadmium (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .108767
Variance = .004258
C.V. = 0.6
97th percentile daily values = .264676
97th percentile 4 day average = .180965
97th percentile 30 day average= .131179
< Q.L. = 10
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0.17
0.3
0
0
0
0.4
0.1
0.2
0.4
0
0.1
0.1
0
0
0
0
0
0

10/23/2008 3:34:22 PM

Facility = Roanoke River expected value
Chemical = chloride (mg/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 66
Expected Value = 10.6064
Variance = 10.7282
C.V. = 0.308811
97th percentile daily values = 17.8788
97th percentile 4 day average = 13.9909
97th percentile 30 day average= 11.7313
< Q.L. = 0
Model used = lognormal

No Limit is required for this material

The data are:

14.4
9.8
9.5
7.9
7.8
8.4
9.2
8.1
9.3
9.3
9.2
6.9
10.7
7.7
8.4
7.2
7.6
13.4
9
9
9.5
9.1
9.9

Chloride

Roanoke River expected value

10
9.2
8.5
7.5
6.5
5.6
7.3
9.6
10.1
10.2
9.6
11.2
10.3
12.4
24.5
37.9
13.4
7.9
8.85
14
7.1
14.1
10.6
10.9
7.9
17
11.7
11.7
9.4
13.3
13.5
11.8
15.6
6.9
11.2
11.7
11.4
12
11.4
12.1
7.7
10.9
9.9

10/27/2008 9:57:43 AM

Facility = Roanoke River expected value
Chemical = chromium III (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .844147
Variance = .256530
C.V. = 0.6
97th percentile daily values = 2.05416
97th percentile 4 day average = 1.40448
97th percentile 30 day average= 1.01808
< Q.L. = 13
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

2
0
0
0
0
0
0
0
0
0
0
0
0
0
0
1
1
1.6
6

10/27/2008 9:33:59 AM

Facility = Roanoke River expected value
Chemical = dissolved copper (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = 1.83849
Variance = 2.51251
C.V. = 0.862167
97th percentile daily values = 6.01001
97th percentile 4 day average = 3.35721
97th percentile 30 day average= 2.31455
< Q.L. = 8
Model used = delta lognormal

No Limit is required for this material

The data are:

0
1
3
1
4
3
1
0
2
0
2.5
1
0
0
0
0
6
0

10/27/2008 9:38:08 AM

Facility = Roanoke River expected value
Chemical = dissolved lead (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 0.5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = 2.05581
Variance = 8.04612
C.V. = 1.379775
97th percentile daily values = 9.20149
97th percentile 4 day average = 4.77785
97th percentile 30 day average= 2.90773
< Q.L. = 8
Model used = delta lognormal

No Limit is required for this material

The data are:

0
3
2
1
5
4
1
13
2
1.5
0
0
0
0
0
0
1
0

10/27/2008 9:58:46 AM

Facility = Roanoke River expected value
Chemical = dissolved mercury (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .084414
Variance = .002565
C.V. = 0.6
97th percentile daily values = .205416
97th percentile 4 day average = .140448
97th percentile 30 day average= .101808
< Q.L. = 13
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0
0
0
0
0
0
0
0
0
0
0
0
0.1
0.1
0.2
0.1
0.4

10/27/2008 9:53:16 AM

Facility = Roanoke River expected value
Chemical = dissolved nickel (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .998867
Variance = .359185
C.V. = 0.6
97th percentile daily values = 2.43066
97th percentile 4 day average = 1.66190
97th percentile 30 day average= 1.20468
< Q.L. = 11
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0
14
1
5
1
1
0
0
4
1
0
0
0
0
0
0
0

10/27/2008 10:25:43 AM

Facility = Roanoke River expected value
Chemical = dissolved selenium (ug/)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 2
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 19
Expected Value = .984739
Variance = .349096
C.V. = 0.6
97th percentile daily values = 2.39628
97th percentile 4 day average = 1.63839
97th percentile 30 day average= 1.18764
< Q.L. = 18
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

2
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0

10/27/2008 9:51:34 AM

Facility = Roanke River expected value
Chemical = dissolved silver (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 0.1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .108767
Variance = .004258
C.V. = 0.6
97th percentile daily values = .264676
97th percentile 4 day average = .180965
97th percentile 30 day average= .131179
< Q.L. = 10
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

0
0.7
1.6
0
0.6
2.8
2.3
11
1.8
1.1
0
0
0
0
0
0
0
0

10/27/2008 9:36:37 AM

Facility = Roanoke River expected value
Chemical = dissolved zinc (ug/L)
Chronic averaging period = 4
WLAa = 200
WLAc = 200
Q.L. = 0.4
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 18
Expected Value = .466476
Variance = .078336
C.V. = 0.6
97th percentile daily values = 1.13513
97th percentile 4 day average = .776118
97th percentile 30 day average= .562595
< Q.L. = 9
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

14.8
33
0
0
11
15
0
0
0.4
0
0
0
10
0
0
10
60
10

WVWA WPCP
VA0025020

Antidegradation Background Calculations
(35 MGD facility prior to expansion)

Low flow stream flows given when facility was 35 MGD prior to expansion to 42 MGD
Effluent data collected from 1994 - 1997 used to calculate expected effluent concentration
Upstream data collected from 1994 through 1998 used to calculate expected upstream concentration
Background stream concentration prior to 42 MGD upgrade = effluent concentration + upstream concentration
Existing stream concentrations determined during acute and chronic flow conditions.

Qex=(QsCs + QeCe)/(Qs+Qe)

Parameter zinc, dissolved

Expected Value stream	0.466476	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	30.9395	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**19.31**	ug/L
chronic	**18.45**	ug/L
human health	**15.75**	ug/L

Parameter copper, dissolved

Expected Value stream	1.83849	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	2.94101	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**2.52**	ug/L
chronic	**2.49**	ug/L
human health	**2.39**	ug/L

Parameter lead, dissolved

Expected Value stream	2.05581	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	2.11472	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**2.09**	ug/L
chronic	**2.09**	ug/L
human health	**2.09**	ug/L

WVWA WPCP
VA0025020

Antidegradation Background Calculations
(35 MGD facility prior to expansion)

Parameter: mercury, dissolved

Expected Value stream	0.084414	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	0.078827	ug/L		

low flow 1Q10	21.6 MGD
low flow 7Q10	24.3 MGD
30Q5	34.8

Low Flow Conditions

acute	**0.081**	ug/L
chronic	**0.081**	ug/L
human health	**0.082**	ug/L

Parameter: silver, dissolved

Expected Value stream	0.108767	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	1.71602	ug/L		

low flow 1Q10	21.6 MGD
low flow 7Q10	24.3 MGD
30Q5	34.8

Low Flow Conditions

acute	**1.103**	ug/L
chronic	**1.057**	ug/L
human health	**0.915**	ug/L

Parameter: chromium VI

Expected Value stream	0	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	0.4684	ug/L		

low flow 1Q10	21.6 MGD
low flow 7Q10	24.3 MGD
30Q5	34.8

Low Flow Conditions

acute	**0.290**	ug/L
chronic	**0.276**	ug/L
human health	**0.235**	ug/L

WVWA WPCP
VA0025020

Antidegradation Background Calculations
(35 MGD facility prior to expansion)

Parameter selenium, dissolved

Expected Value stream	0.984739	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	0.731296	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**0.828**	ug/L
chronic	**0.835**	ug/L
human health	**0.858**	ug/L

Parameter chloride

Expected Value stream	10606.4	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	71000	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**47952.27**	ug/L
chronic	**46251.86**	ug/L
human health	**40889.72**	ug/L

Parameter nickel, dissolved

Expected Value stream	0.998867	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	7.09557	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**4.77**	ug/L
chronic	**4.60**	ug/L
human health	**4.06**	ug/L

WVWA WPCP
VA0025020

Antidegradation Background Calculations
(35 MGD facility prior to expansion)

Parameter arsenic, dissolved

Expected Value stream	0.60786	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	0.656565	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**0.64**	ug/L
chronic	**0.64**	ug/L
human health	**0.63**	ug/L

Parameter cadmium, dissolved

Expected Value stream	0.108767	ug/L	Effluent Design Flow	35 MGD
Expected Value effluent	0.352513	ug/L		

low flow 1Q10	21.6	MGD
low flow 7Q10	24.3	MGD
30Q5	34.8	

Low Flow Conditions

acute	**0.26**	ug/L
chronic	**0.25**	ug/L
human health	**0.23**	ug/L